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LAND ECONOMICS

a quarterly journal of

PLANNING, HOUSING & PUBLIC UTILITIES

How Will Atomic Power Affect the Electric Power Industry?....E. W. Morehouse *and* Theodore Baumeister

Economics and the Public Interest.....L. G. Hines

Some Fundamentals of Mineral Economics.....Orris C. Herfindahl

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"WHATEVER MAY BE THE LIMITATIONS WHICH TRAMMEL INQUIRY ELSEWHERE WE BELIEVE THE GREAT STATE UNIVERSITY OF WISCONSIN SHOULD EVER ENCOURAGE THAT CONTINUAL AND FEARLESS SIFTING AND WINNOWING BY WHICH ALONE THE TRUTH CAN BE FOUND."

From Report of Board of Regents, University of Wisconsin, 1894

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AMERICAN ECONOMIC REVIEW

Contents

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The Analysis of Devaluation ---------- *Fritz Machlup*

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Obsolescence and Technological Change ---------- *Marvin Frankel*

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CONTENTS — MAY 1955

How Will Atomic Power Affect the Electric Power Industry?.....E. W. Morehouse *and* Theodore Baumeister..... 93
Economics and the Public Interest.....L. G. Hines.....108
Institutions, Ground Water, and Overdraft—An Aspect of Irrigated Agriculture.....J. Herbert Snyder.....120
Some Fundamentals of Mineral Economics.....Orris C. Herfindahl.....131
Is the Theory of the Firm Misused in Current Land Economics Research?.....C. Clyde Mitchell.....139
Mechanics of the Urban Economic Base: Causes and Effects of Change in the Base Ratios and the Ratio Elements (1).....Richard B. Andrews.....144

Reports and Comments

The Accumulation of Wealth in the Form of Land Ownership in Underdeveloped Areas.....Robert Solo.....156

Book Reviews

The House and the Art of Its Design (Kennedy).....Lloyd Rodwin.....161
The Economics of Location (Losch).....John M. Kuhlman.....162
Planning Residential Subdivisions (Kostka).....Edward Flickinger.....163
Urban Traffic (Mitchell and Rapkin).....Walter K. Johnson.....163
Ocean Transportation (McDowell and Gibbs).....Lesslie A. Bryan.....164
Elements of Pure Economics (Walras).....Martin Bronfenbrenner.....164
When the Cathedrals Were White (Le Corbusier).....Stelphen B. Miles, Jr.....166
Japanese Food Management in World War II (Raper).....Arthur F. Raper.....167
Great Cities of the World, Their Government, Politics and Planning (Robson, editor).....Charles S. Ascher.....167
Parking as a Factor in Business (Highway Research Board).....Max Wehrly.....169
Comparative Population and Urban Research Via Multiple Regression and Covariance Analysis (Bogue & Harris).....Ralph Thomlinson.....169
Organized Industrial Districts (Pasma).....Robert L. Wrigley, Jr.....170
The Nation Looks At Its Resources (Resources for the Future).....Fred A. Clarenbach.....170
Agricultural Development and Rural Reform in Denmark (Skrubbeltrang).Frank Meissner.....172

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How Will Atomic Power Affect the Electric Power Industry?

By E. W. MOREHOUSE* *and* THEODORE BAUMEISTER**

ATOMIC energy for electric power production, for the propulsion of ships, and even of aircraft, has been much in the headlines these days. The Eisenhower international atomic power proposal and the 1954 amendments of the U. S. Atomic Energy Act to permit development by industry have combined to make almost daily head-line news. Much publicity is currently given to the hazardous effects of nuclear bombs—not only in their immediate destructive effects by blast, but more insidiously by their delayed contamination from fall-out of radioactive elements. No government official or body can issue any printed statement today, nor can any corporate management deliver an annual report to stockholders, without devoting paragraphs or pages to the subject of atomic energy.

The authors lately had occasion to prepare a statement on the subject of atomic power for the stockholders of General Public Utilities Corporation (GPU). This statement was not mailed directly to stockholders but rather a post card was included with a dividend check together with a note that if the stockholder wished to know "how atomic energy affects us" he should return the card. The response was most significant —more than 15,000 stockholders, 25% of total, accepted the invitation and wrote for a copy of the pamphlet. This response was so remarkable that the authors felt that the subject could well be treated in a somewhat expanded over-all manner in *Land Economics.*

While the prospects of nuclear energy offer many attractions for fields such as the military and naval services, for agriculture and for industry, this discussion is confined to peace-time applications for the generation of electric energy. In this respect the raw energy of nuclear fission is to be considered in the light of its potential competition with (1) hydropower and primarily (2) steam or internal combustion engines utilizing variously the fossil fuels—coal, oil and natural gas. The analysis which is given here is directed toward the significance of atomic electric power, and some of its chief developmental problems, prospects, and impact on the investments aggregating

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more than $30 billion which have been made in the electric utility industry.

Nuclear Fuel Advantages

The energy released per unit of weight by fission or fusion of the nucleus of an atom is tremendous. It is sometimes said that one pound of uranium metal the size of a one-inch cube is equivalent, energy-wise, to about 1,300 tons of average grade bituminous coal.

Nuclear fuel has an enormous economic potential by reason of its concentration of energy in relatively small weight and bulk. Some comprehension of this may be had by comparison with a modern coal-fired plant related to such plants of around 1900. Figure 1 shows the trend in the amount of coal required to beliver 1 KWH of electrical energy from

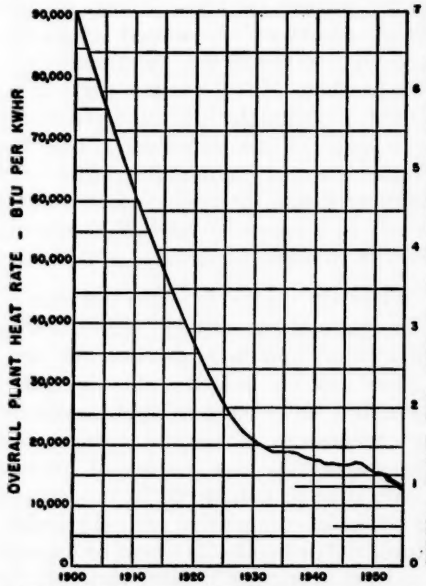

FIGURE 1—Overall Thermal Performance of Fuel-Burning Electric Utility Power Plants in the United States, 1900-1951: Adapted from Federal Power Commission Data. Theodore Baumeister, "Steam and Electric Power—Its Past and Future," *Combustion*, December 1952.

1900 to 1954. Translated into quantities, a representative size of a modern plant would be in the order of 300,000 KW capability. Such a plant today at an efficiency rate of less than .75 pounds of coal per KWH would use not far short of one million tons of coal a year, whereas by 1900 standards a plant of similar size would have required 10 million tons a year. But a plant of this size tomorrow, using nuclear fuels, would need only about 1,000 *pounds—half a ton*—of nuclear fuel a year.

Obviously this feature of nuclear fuel minimizes fuel transportation costs as an element in electric power costs, unless offset by costs of a different character.[1] It also opens up a new broad latitude of choice in location not only of power plants but of industrial plants using electric power. It could make power available and industrialization possible in areas which are power- and industry-starved today. This vista, of course, is subject to the availability of adequate water supplies both for power and industrial development, a limiting factor too little appreciated or considered in appraising "Point 4 rainbows." Thus far, the use of nuclear fuel is still tied to the steam cycle in electric power production. Parenthetically, it may be noted that the high concentration of energy in nuclear fuel makes atomic fuel plants attractive for at least some transportation services—such as ships—and perhaps others when shielding weight problems are solved.

To the advantages of concentration of energy per unit of weight should be added the huge volume of energy supplies in nuclear fuel compared with fossil fuels as an attractive feature of this new energy source. The estimated supplies of the world's fuels are summarized in Table I.[2]

[1] In addition to possible costs of a different character are the costs in terms of coal and oil or gas used to develop power for operating the process whereby, for example, U-235, which is fissionable, is separated out from natural uranium, U-238, which is not fissionable in its natural state.

[2] Taken from J. L. Schanz, "Prospects for Nuclear Power —What's the Score?" *Electric Light and Power*, December 1954.

TABLE I—World Reserves of Fossil Fuel and Nuclear Energy*

Fuel	World Reserves	Source of Data	Unit Energy	Total Energy (Btu)
Crude Oil	610 billion barrels	Weeks and Moulten	6.4×10^{6}	35×10^{17}
Natural Gasoline	11.5 billion barrels	American Petroleum Institute	6.4×10^{6}	0.74×10^{17}
Shale Oil	620 billion barrels	Bureau of Mines	6.4×10^{6}	40×10^{17}
Natural Gas.	560 trillion cu.ft.	American Gas Association	1000 Btu per cu. ft.	6×10^{17}
Coal	3482 billion tons	Bureau of Mines	13,500 Btu 14,000 Btu 9,000 Btu	722×10^{17}
TOTAL CONVENTIONAL FUEL				80×10^{18}
Uranium	25 million tons	Raw Materials Div. of AEC	3.5×10^{10}	1700×10^{18} at 1-to-1 breeding
Thorium	1 million tons	Raw Materials Div. of AEC	3.5×10^{10}	71×10^{18}
TOTAL NEW FUEL				1771×10^{18}

*J. L. Schanz, "Prospects for Nuclear Power . . . What's the Score?" *Electric Light and Power*, December 1954.

It is noteworthy that the estimated supply of fissionable raw material (uranium and thorium) is 23 to 25 times the total estimated reserves of all fossil fuels, such as coal, oil and gas.

Energy Demands

Against this enormous energy supply potential, however, should be scaled the dizzy pace of population growth and of per capita electric energy requirements. Past history in this country has indicated that electric power requirements have about doubled each decade. The United States, however, has one of the highest rates of developed use of electric energy in the world, as well as a high level of family incomes, but until recent years its rate of natural population growth has been behind that of other countries in the world. The upsurge of population growth since World War II, coupled with continued growth of per capita incomes and energy requirements, has multiplied the prospective future energy needs. (See Table II and Fig. 2 for a 15-20 year "crystal-ball" gaze.)

TABLE II—Capability of U. S. Interconnected Electric Power Systems

Year	Kilowatts (millions)	
Actual	*Amount*	
1945	50.1	
1950	68.9	
1955 (Jan. 1)	102.5	
Forecast	*Upper*	*Lower*
1965	218	181
1975	423	301

Source: Walker L. Cisler, "Looking Ahead to the Last Quarter of the First Century of Electric Power in the United States," Edison Electric Institute, 22nd Annual Convention, June 1954.

Consider, however, the growth potential in most of the other countries of the world which are "power-starved." Palmer Putnam,[3] trying to take a world-wide look into the future, estimates that population is increasing at compound annual rates of growth of nearly 1% (Putnam, p. 251) and that energy requirements are mounting at compound annual rates of growth of about 3 or 4% (Putnam, p. 251). Small wonder, therefore, that consideration of such figures leads to but one conclusion: With population growing by leaps and bounds and with energy requirements likewise growing at a dizzy pace, not only in this country but the world over, it is simply prudent foresight to develop the tre-

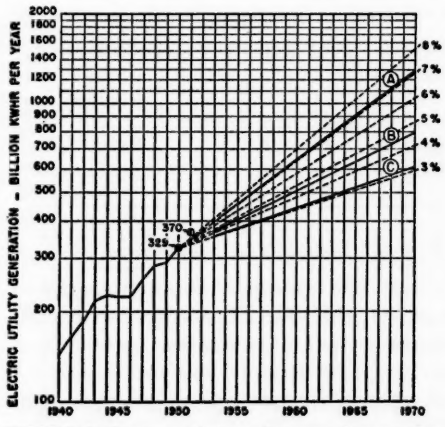

FIGURE 2—ESTIMATED ANNUAL ELECTRIC UTILITY OUTPUT TO 1970 IN THE UNITED STATES. Theodore Baumeister "Steam and Electric Power—Its Past and Future," *Combustion*, December 1952. Broken lines show annual growth rates of 3 to 8 percent as applied to 1950 generation of 329 billion kilowatt-hours. Solid lines show growth rates as related to population. Curve A is from the extrapolated per capita consumption trend of the last three decades. Curve B is from the same per capita consumption growth as prevailed during the 1940-50 decade. Curve C is from the average per capita consumption of the last three decades.

mendous nuclear fuel supplies, with such concentrated energy per unit of weight, for future use when supplies of conventional fuels begin to run out and become very costly. This, too, was the unchallenged position of the so-called Paley Commission as to the United States only a few years ago.[4]

The New Fuel Technology

This is the significance of nuclear materials as fuel for electric power production in the tomorrows stretching ahead of us. The electric power industry has grown as rapidly as it has by constantly, vigorously pursuing improved technology —"know-how"—in both producing and using electricity. That vigorous pursuit must go on.

The splitting of an atom takes place in a machine called a "reactor." The heat energy produced in the reactor, in the process generally proposed today, is then used to make steam in a boiler. The steam produced drives a conventional steam turbine which in turn rotates the generator and delivers electricity to the conventional station bus bars. Note that the nuclear furnace displaces only a portion of the boiler plant, which ordinarily accounts for about 15 to 20 percent of total power system investment. The remaining power plant equipment, as well as the transmission and distribution systems to bring electric service to the consumer's doorstep, are all identical with our present facilities. Therefore those inclined to worry about wholesale obsolescence of power systems can relax; for economic reasons also, as touched upon later, the picture of risk of wholesale obsolescence due to use of atomic power has been overpainted.

A great many reactor designs can be, have been, and are being promoted. The possible variants in choice include such items as fuel, fertile materials, coolants and heat transfer media, moderators,

[3] Palmer Putnam, *Energy in the Future* (New York: Van Nostrand Company, 1953). See also, generally, Eugene Ayres and Charles A. Scarlott, *Energy Sources, The Wealth of the World* (New York: McGraw-Hill Book Company, 1952).

[4] The President's Materials Policy Commission, *Resources for Freedom*, June 1952.

shielding, type and preparation of fuel elements or forms, and fission reactor controls which give a very large number of possible different kinds of reactors. This diversity of approach is needed and healthy in developing a new fuel technology such as this. As time goes on and construction and operating experience accumulate, certain designs will stand out in the competition as holding forth most promise for future development. This too is part of the growing pains of a new technology.

Many of these reactor types, on a small experimental scale, with a few on a larger scale, have been built and operated by the government. Last year, almost coincident with the amendment of the Atomic Energy Act to open the door substantially to private development as compared with the previous government monopoly, the U. S. Atomic Energy Commission established a Five-Year Reactor Development Program. The high-lights of this program are summarized in Table III.[5]

A comparative appraisal of the five reactor cycles in Table III in terms of promise for economical electric power production, is a subject by itself. It will not be attempted here, beyond noting the opinion of a group of experts (Table III, last column) and that the experience with these types will be valuable for future variations of design and development. We should record, however, that only one of these reactor plants, from the standpoint of electric power production by utility systems, may clearly be said to be on a commercial scale. That is the so-called "pressurized water" reactor (PWR) being built by the government at Shippingport, Pennsylvania, with the cooperation of Duquesne Light Company and Westinghouse Electric Corporation. This plant is being designed, largely on the basis of the submarine reactor already constructed by Westinghouse for the U.S.S. Nautilus, to produce 60,000 KW of electric power. Admittedly, it is experimental in that it will not produce power as cheaply as can be done in that area now by new conventional fuel plants.

Another government-sponsored and financed program in this field is the "Army Package Power Reactor" program (APPR).[6] This program calls for a "package" nuclear power plant for military use at remote bases and transportable by air. Though small in electrical capacity (2,000 KW), the feasibility and transportability of such plants could materially affect industrial location and development in distant or remote places, not economically reachable by commercial electric facilities. The reactor design—pressurized light water reactor using enriched uranium fuel—is not novel but two features of the program are noteworthy: (1) it definitely seeks to capitalize on the concentrated nature of nuclear fuel; and (2) firm price proposals (as distinguished from cost-plus proposals) were invited. Eighteen proposals were submitted by industrial firms and the proposal by American Locomotive Company was accepted.

In addition, under the amended Atomic Energy Act of 1954, the Commission is shaping a Power Demonstration Reactor Program to encourage private development of various reactor types. Press announcements released for April 7, 1955 have indicated that four proposals have been received under this Program; and in addition, Consolidated Edison Company of New York has applied for a license to build and operate a nuclear power plant entirely with private capital. Certain salient features of

[5] *See* U. S. Atomic Energy Commission, *Major Activities in Atomic Energy Programs*, January 1955, pp. 19-31, at p. 37.

[6] *Ibid.*, pp. 27-28.

TABLE III—AEC DEVELOPMENT PROGRAM FOR CIVILIAN POWER REACTORS[1]

Reactor Concept	Name	Symbol	Location	Scheduled Completion Date	Moderator	Coolant	Fuel	Experimental Scale	Thermal Capacity		¶ KW	Investment (Millions)	Proximity to Full Scale Reality (Yrs.)	Economic Promise[2]
									10^6 Btu per Hr	KW				
Pressurized Water	Pressurized Water Reactor	PWR	Westinghouse, Shippingport, Penna.	1957	Ordinary Water (H_2O)	Ordinary Water (H_2O)	Slightly Enriched Uranium	Full	900	264,000	60,000	$85	2-3	5
Boiling Water	Experimental Boiling Water Reactor	EBWR	Argonne NL, Chicago	1956	Ordinary Water (H_2O)	Ordinary Water (H_2O)	Natural and Highly Enriched Uranium	Medium	68	20,000	5,000	$17	Less than 5	3
Sodium Graphite	Sodium Reactor Experiment	SRE	North American, Santa Susana, Cal.	1955	Graphite	Sodium	Slightly Enriched Uranium	Medium	68	20,000	None	$10	2-3	4
Fast Breeder	Experimental Breeder Reactor, No. 2	EBR-2	Not Selected	1958	None	Sodium	Uranium-Plutonium Alloy	Medium	214	62,500	15,000	$40	More than 5	2
Homogeneous	Homogeneous Reactor Experiment No. 2	HRE-2	Oak Ridge NL, Tennessse	1955	Heavy Water (D_2O)	Heavy Water (D_2O)	Highly Enriched Uranium in UO_2SO_4 Solution	Small	17	5,000	300	$47	More than 5	1
Homogeneous	Homogeneous Thorium Reactor	HTR	Not Selected	1959	Heavy Water (D_2O)	Heavy Water (D_2O)	Highly Enriched Uranium in UO_2SO_4 Solution	Medium	222	65,000	16,000		More than 5	1

Ref.: [1]17th Semi-Annual Report of the Atomic Energy Commission (largely).
[2]*Report of Sub-Committee on Research and Development of Joint Committee on Atomic Energy*, March 1954, p. 3.

these proposals are summarized in Table IV, with notes as to chief participants made known to date.[7]

Power Development Associates, Inc. (APDA), has solicited firm proposals on a projected 250,000 KW nuclear plant to

TABLE IV—PROPOSALS AS OF APRIL 1, 1955 IN AEC POWER DEMONSTRATION REACTOR PROGRAM

Company or Group Sponsor	Type of Reactor	Expected Date of Completion	KW Electrical Capacity	Sponsor Companies
I. PROGRAM PLANTS				
1. Yankee Atomic Electric Co.	Light Water Moderated and Cooled Reactor	1957	100,000	Group of 12 New England Utility Companies, headed by New England Power Company
2. Group of APDA participants headed by Detroit Edison Company	Fast Breeder Reactor	1958	100,000	Group of 9 companies, members of Atomic Power Development Associates (APDA) located in East and Middle-West headed by Detroit Edison Company*
3. Nuclear Power Group	Boiling Water Reactor	1960	180,000	Nuclear Power Group, composed of American Gas and Electric Co., Bechtel Corp., Commonwealth Edison Co., Pacific Gas & Electric Co., and Union Electric Company
4. Consumers Public Power District, Nebraska	Sodium Graphite Reactor	1959	75,000	Consumers Public Power District
II. LICENSED PRIVATE PLANT				
5. Consolidated Edison Co. of N. Y.	Light Water Cooled and Moderated Reactor	5-year construction period	250,000	Consolidated Edison Co. of N. Y.

* In addition to Detroit Edison Company, the companies were: Consumers Power Company, Philadelphia Electric Company, Cincinnati Gas & Electric Co., Toledo Edison Company, Rochester Gas and Electric Corporation, Delaware Power and Light Company, Central Hudson Gas & Electric Corporation and Long Island Lighting Company.

The Consolidated Edison Company, which is one of the members of Atomic

be located at Indian Point, Buchanan, New York, 24 miles up the Hudson River from New York City. The nuclear part of the plant will be from the designs of The Babcock & Wilcox Company. The plant is expected to cost about $55 million, or $230 per KW, and to deliver energy for a total cost of about 9 mills per KWH. An interesting feature of the

[7] In addition to these activities it should be recalled that there are some eighteen industrial participation study teams that have contracted with the Commission, each group consisting of one or more contractors. These study teams, many of which have worked for several years, are investigating various phases of the new nuclear technology. They embrace the vast majority of investor-owned electric utility assets in the country. For further details consult the semi-annual reports of the United States Atomic Energy Commission, *Major Activities in the Atomic Energy Programs.*

planned design is the use of an oil-fired superheater to raise the temperature of steam at the reactor loop outlet to the level appropriate for a modern type of turbine, thus bridging the gap between a new and a more mature technology and boosting the over-all thermal efficiency of the plant (10,700 Btu. per KWH). This development is frankly admitted to be somewhat more expensive than a conventional fuel-fired plant but, with the blessing of the many regulatory commissions which must approve the plans, it is the hope of the management to foster a real forward step in this whole broad area.

As noted in the AEC release, "this (Consolidated Edison) plant combined with the other four proposals would total 705,000 kilowatts of installed electric capacity, costing about $205,000,000." Per unit of capacity, this is equivalent to about $290 per KW.

The United Kingdom has announced the start of a program to build 16 full-scale reactor power plants in the next decade. This program would use gas-cooled reactors initially and primarily, because of their immediate availability and consequent maximum utility, and later progress to liquid-cooled types. All the reactor designs seem less advanced and thermally efficient than some of the American designs but they should achieve the British goal of commercial production of electricity by atomic energy on a national scale probably sooner than in this country. The whole program is designed to meet the economic consequences of impending shortages in conventional fuels, especially coal, owing to inability to mine enough coal for expanding electric and other energy requirements and unwillingness to rely on imported coal. This British program has many attractive features set by the high competitive costs of fossil fuels in the British Isles. The economic justification is much easier in such a high-cost fuel area and the successful harnessing of nuclear energy should prove to be of material benefit to the entire British economy.

Problems

A host of problems must be solved before atomic power plants will be developed to a point of technical and economic feasibility and before they will be installed to any appreciable extent in this country. Most of these problems may be grouped under three major heads: (1) Legal, (2) Technical, and (3) Economic. It may help in appraising both the present and future status of atomic power if some aspects of these problems are briefly noted.

Legal

The original Atomic Energy Act of 1946 established a 100% government monopoly of atomic energy, confirming the policy established during World War II as a matter of national defense and military necessity. In 1954 the law was liberalized to the extent of permitting, under government license, private ownership and operation of equipment and facilities but retaining in the government the ownership of fissionable material, though it may be licensed for private use. An elaborate system of licensing, inspection and regulation was also set up in the amended Act, so that private development still has a number of legal hurdles to surmount. Among the serious remaining legal obstacles are (a) the public liability for damage accompanying failure or explosion of a nuclear power plant and (b) the assurance of a continuing supply of fuel from government sources at a guaranteed fair price "not to exceed

seven years" from July 1, 1955.[8] The resolution of these legal matters is a necessary ingredient for the practical utilization of atomic energy.

There are no insurance actuarial data on which to measure the risks from the operation of a nuclear plant. While the hazards are not like those which would come from the blast effects of an atomic bomb, there are the much more subtle and elusive consequences of a flare-up from a reactor where radioactive particles might be discharged to the atmosphere with subsequent fall-out, contamination, and damage at remote points—many miles away. Although the insurance industry is exploring this matter, no definitive offers of insured coverage have been made. Yet the Atomic Energy Act of 1954 contains the noted provision requiring licensees to hold the government harmless from any damage claims resulting from use of fissionable material. With no insurance coverage yet available, it is small wonder that most of the proposals made under the Power Reactor Demonstration Program were conditioned to limit liability on that account. This is one of the areas in which costs of insured coverage on risks of loss from damage claims are largely unknown.

Technical

The technical problems which remain unsolved are large in number and complicated in detail. But vast expenditures of money by government and by industry in support of nuclear research will ultimately lead, we are confident, to solutions of these problems. The bold program of the British in their projected construction of many nuclear plants will teach many lessons of value and the reality of reliable plants will be demonstrated. None of these British plants is of a type which is presently pictured as offering the ultimate solution. However, it is essential to get beyond the laboratory stage and to operate full-scale equipment on the routine job of day-to-day meeting of the power loads. Experiment, research, calculations and design can never displace experience. The ultimate answers are to be found in projects such as these British plants, the installations at Shippingport, Pennsylvania, and those summarized in Table IV.

The bulk of these technical problems revolves around the reactor part of the plant and how it should look and work, on which there is a wide diversity of ideas even among skilled technicians. Indeed one of the major technical problems in the reactor is in the fuel element itself. As Dr. L. R. Hafstad, until recently AEC Director of Reactor Development and now Director of the Atomic Energy Division of The Chase Manhattan Bank, has said: "We need a fuel element which will stand high temperature, have long-life—that is, permit high burn-up—and be cheap and easy to fabricate and reprocess. No fuel element we have yet been able to devise is adequate in all these respects. The homogeneous (fuel in a liquid solution) reactor approach, while avoiding these particular troubles, encounters other troubles of its own due to corrosion caused by hot, radioactive fuel solutions."

For the more technically minded, here is a list of some of the problems of improving technology regarded by many as critical in making atomic energy economically feasible: "1. Radiation shielding and disposal of fission wastes (ashes.) 2. Chemical separation of fuels from wastes. 3. Exclusion areas. 4. Corrosion resulting from radiation and liquid metal coolants have required new de-

[8] This provision has already been criticized. See testimony of C. G. Suits and Francis K. McCune, Vice Presidents of General Electric Company, before Joint Committee on Atomic Energy on "Development, Growth and State of Atomic Energy Industry," 84th Congress, First Session, 1955, pp. 389 and p. 548.

velopments in metallurgy. 5. Development of pumps and other equipment to transfer coolants. 6. Breeding of fuel."[9]

Each of these six categories of problems has many clearly identifiable elements which emphasize the magnitude of the situation. For example, on the question of waste disposal, industry has had no similar serious problem in its entire history. Stream and air pollution are no longer tolerated. In coal-burning operations the ash which is left from a modern powerhouse of substantial size can easily run to a hundred tons a day. A dump to accommodate refuse in this volume is a very serious problem in many localities. But that problem is dwarfed compared to the disposal of fission wastes which can remain radioactive for a considerable time. Even such proposals as encasement in a heavy concrete block and dumping far at sea do not offer a practical answer. If the casing disintegrates before the radioactivity has reached a safe level, the contamination can be picked up by marine life and returned to man in his diet. There is no waste disposal problem with conventional fuels which can even approach this problem in severity, in hazard both to operating personnel and the public generally, and in costs.

Although much experience has been gained over the years on how to live with the new hazards of neutrons and gamma radiation, and only a couple of instances of "runaway" conditions in reactors have been publicly noted (though without serious consequences), there are still present many unknowns. No matter how skillful the designers and operators may be, there are always present unforeseen and unforeseeable risks. The human race has been boiling water for thousands of years, yet the stringency of boiler construction codes, the policing and licensing of operators, and the close supervision of insurance inspectors do not preclude boiler explosions. They do occur on occasion. On paper, the hazards of reactor operation appear more far-ranging and insidious, both to operating personnel and the public, than the hazards of boiler operation but, in practice, despite only a dozen years' experience with relatively few reactors, it is believed these hazards can be easily exaggerated, in view of control mechanisms and protective structures now contemplated. Nevertheless, to be on the safe side, AEC has imposed some fairly rigid exclusion area requirements, though with a prospect of considerable relaxation as technology advances. These requirements add to comparative investment and operating costs.

The impact of emanations from fission reactions on human beings is not confined to biological lethal dosage. The effects on even the most highly respected metals, like stainless steel, are equally disastrous. Structural materials are distorted and lose their desirable physical, chemical and thermal properties. In fact this impact of intense bombardment of metals by nuclear particles and radiation calls for an entire new metallurgy. Estimates of the scope of this problem range so large that it has been recently stated that:

"Some of the problems that have been met can be understood by looking at the general breakdown of funds spent in nuclear engineering over a number of years and covering several projects including the STR (Submarine Thermal Reactor). Roughly, 28.1 percent has gone into mechanical engineering, including heat transfer; 36.8 percent has gone into metallurgy and metallurgical engineering work; 11.2 percent has gone into theoretical and experimental physics work; 11.3 percent has gone into electric and electronic engineering development; 6.9 percent has gone into chemistry and chemical engineering, and 5.7 percent has gone into opera-

[9] From *Peacetime Prospects of Atomic Energy* (New York: The Chase National Bank, now The Chase Manhattan Bank).

tional engineering and testing. The predominant effort clearly has been in fields of specialization other than physics."[10]

Various reactor types have been proposed to solve these technical problems. Research, development and testing of the more promising types form the core of AEC's 5-Year Reactor Development Program (Table III). Among these reactor-types are two which hold forth much long-range promise—the so-called "fast-breeder" reactor and the homogeneous reactor with fuel in liquid solution.

The breeder reactor is one in which the splitting of the atom is such as to produce more fissionable material than is "burned up" in the chain reaction. This breeding process holds promise of attaining a minimum or negative fuel cost. In other words, the sale of the by-product fissionable material may bring in more than the cost of such material "burned up" in the heat-releasing fission process. This saving tends to offset heavy charges for depreciation, taxes and return on the relatively high capital expenditure for the reactor and fuel inventory themselves. When the breeder-type of reactor is chosen, a new risk or uncertainty enters in that without knowing the market for this new fuel, an extra investment has to be made to reach it. This type of reactor, however, when using solid fuel elements, requires large expenditures for removing and reprocessing partly "spent" fuel elements that are dangerously "hot" or radioactive.

On the other hand, the liquid fuel, "homogeneous" reactor offers promise of avoiding these heavy costs of fuel removal, handling and reprocessing by pumping like a liquid chemical. But this poses metal corrosion problems of great difficulty, especially if a rate of activity to attain "breeding" is sought.

Another costly and difficult technical phase of operating atomic furnaces is the need for removal from time to time of fission fragments which otherwise would "poison" or slow down the reactor. These fission products are highly radioactive and hence must be removed by expensive remote control methods not normal to everyday chemical practice, and are therefore an important element in the economics of atomic power plants.

Economic

Economic problems constitute the third significant element in any attempt to harness the atom. A nuclear power plant must equal or eclipse the *reliability* and *cost* of modern, conventional, increasingly-efficient methods of power generation. Nuclear power plants do not compete with the *average* conventional, fossil-fuel plant; they must equal or better the most economical conventional plant of today and tomorrow—the plant which stands on the frontier of an advancing technology.

The crux of the economic problem lies in the high investment cost of nuclear fuel plants. To compete with new efficient, conventional fuel plants, a nuclear fuel plant must reduce its fuel expense to a nominal or negative amount to offset the higher fixed charges on the higher investment cost. This puts a premium on developing a "breeder" reactor if the offsetting economic handicaps of fuel element reprocessing and fission product removal can be overcome or minimized. This is especially true for a region such as the western part of Pennsylvania in the GPU system where coal costs now only 17¢ per million Btu, about half the cost of coal on the eastern seaboard, and where consequently the savings on nuclear fuel from "breeding" will support a smaller

[10] Commander L. H. Roddis, Jr., Reactor Development Division, Atomic Energy Commission and Bureau of Ships, Navy Department, and J. W. Simpson, Assistant Manager, Atomic Power Division, Westinghouse Electric Corporation, "The Nuclear Propulsion Plant of U.S.S. Nautilus," *Westinghouse Engineer*, March 1955.

increment of capital expenditure above that for a conventional fuel plant.

To illustrate, Pennsylvania Electric Company's Shawville Station in the western part of the GPU system was built for less than $150 per KW and its current expense for fuel, labor and maintenance is less than 2 mills per KWH. In a "breeder" nuclear plant, where fuel cost might reach the vanishing point because of possible sale of man-made fuel such as plutonium, the elimination of fuel cost might support an increased investment of $100 per KW. We might then be justified in spending not more than $250 per KW for a nuclear power plant and still break even. However, most estimates of cost of nuclear power plants today are running a great deal more than $250 per KW. Coupled with this high investment cost are such other costs as higher "ash handling" costs for disposal of radioactive waste, the aforementioned insurance costs, and other unusual costs or risks.

Many estimates of comparative costs of electric power from conventional vs. nuclear fuels are beginning to appear.[11] These comparisons are usually expressed in terms of mills per KWH. Such comparisons should be scrutinized carefully to make sure the assumptions upon which the cost estimates are based are comparable and realistic. Very little experience exists as yet, or is public knowledge, with respect to reactor plant costs or operating expenses. Such information is expected to be accumulated gradually as more reactors are built or operated.

To illustrate the importance of these observations, reference is made to a recent cost comparison by General Electric Company and a few brief comments are made about five of the more significant background factors or assumptions. This is not for the purpose of impeaching these particular cost estimates but rather to point out the need, if sound nuclear economics is to develop along with the technology, for critical analysis and development of some "ground rules," based on experience, for economic analyses of this kind. As nuclear technology develops, the managements of utility systems will increasingly have to evaluate for each major generating unit addition a conventional fuel design and an atomic reactor design, in terms of comparative economy, efficiency, investment, operating reliability and costs. For such evaluations a gradual improvement of analytical "ground rules" is of prime importance.

TABLE V—ESTIMATED COSTS OF POWER FROM NUCLEAR STEAM—ELECTRIC PLANTS*

ESTIMATED INVESTMENT, $ per KW	Coal Fired Conventional Steam Plant	Boiling Reactor Plant	Graphite Reactor Plant
Physical Plant	$140	$195	$214
Land	2	2	1
Engineering	11	15	17
Start up	7	14	17
Nuclear fuel inventory	.....	17	28
TOTAL	$160	$243	$277

ESTIMATED COST OF ELECTRIC ENERGY OUTPUT, MILLS PER KWH BASED ON 35¢ PER MILLION BTU OF COAL

Fixed charges	3.0	4.65	5.2
Operating cost	0.5	0.70	0.6
Fuel	3.4	1.35	1.0
TOTAL	6 9	6.7	6.8

* F. K. McCune, "The Approach of the General Electric Company," *Atomic Industrial Forum*, July 1954.

Table V gives GE's estimated costs of electric power for two different designs of reactors in comparison with a modern coal-fired plant. This affords a basis for commenting in preliminary form, and

[11] Early calculations of this nature are found, for example, in Sam H. Schurr and Jacob Marschak, *Economic Aspects of Atomic Power* (Princeton, New Jersey: Princeton University Press, Cowles Commission for Research in Economics, 1950); and, more realistically, in Walter Isard and Vincent Whitney, *Atomic Power, An Economic and Social Analysis* (New York: The Blakiston Company, 1952).

sketchily, upon the importance of at least five factors in the cost analysis and comparison, to wit: (1) load or use factor or availability, (2) fuel costs, (3) fuel processing costs, (4) depreciation, (5) exclusion factor. Each of these aspects is worthy of extended discussion. All that can be attempted here is to sketch some of the important implications of these factors for further anylsis.

The significance of these factors is heightened by the severity of the competition in this country between conventional fuel technology and nuclear fuel technology. The severity of this competition can be seen from the range of costs now being achieved in modern conventional fuel plants. Since 1900 the fuel consumption has been reduced from an average figure of 7 pounds of coal (90,000 Btu) per KWH in 1900 to a figure of just below 1 pound of coal (13,000 Btu) per KWH last year (See Fig. 1). This is the fuel consumption of all the steam electric central stations in the country and represents the vast improvement in fuel economy which has been made possible by a rapidly advancing technology. The end is not yet in sight because there are many plants now in service which require between 9,000 and 10,000 Btu per KWH (0.7 to 0.75 pounds of coal per KWH). Others are being designed and constructed which will completely eclipse these performance figures. It is likely that one or more conventional fuel-burning steam electric generating plants will be delivering a kilowatt hour for less than 8,000 Btu (0.6 pounds of coal) by 1960.

To meet this competition and the competition of tomorrow's best plants, nuclear plants will have to generate power at 4 to 7 mills per KWH, depending largely on cost of coal, oil or gas in the vicinity of the plant. General Electric Company, operator of the Hanford plants for AEC, has recently estimated (See Table V) costs of electric power from two different designs of reactors at 6.7 to 6.8 mills per KWH, which is said to beat slightly the 6.9 mills per KWH cost estimate for a modern coal-fired plant in an area where coal costs are 35c per million Btu, assuming annual fixed charges of 13.7% on a plant cost of $160 KW operating 80% of the hours of the year. Nevertheless, it should be remembered that these reactor cost estimates have not yet been fully proved out by experience.

Now, to illustrate the importance of realistic "ground rules," we comment on the factors listed above:

(1) *Utilization Factor.* GE's figures in Table V are based on use for 80% of the 8760 hours in the year. It is customary for utility systems to operate their newest and most efficient and economical generating units, when designed for base-load operation, as many hours during the year as they can be made available, frequently 90% of the time after the new equipment has been "broken in." This makes for maximum economy. Only as still newer and more efficient machines are brought into service do these hours of use diminish. Hence an 80% utilization factor is well within proven experience for a conventional fuel modern plant over the first several years of its life.

On the other hand, we have no proven experience yet on the availability and reliability of a reactor. In the specifications for bidding on the PWR proposition, reference was made to possible availabilities as low as 10% of the time. In an "around-the-clock" service industry like electric utilities, this becomes important as an economic factor. For example, suppose that 1750 hours do not prove sufficient as "outage" time for making reactor adjustments and repairs, and that only a 60% availability proves

attainable, then the costs per KWH rise to nearly 8.5 mills per KWH.

(2) *Fuel Costs.* Under the Atomic Energy Act of 1954 the government maintains its monopoly of ownership of fissionable material. It merely may lease fuel for use in privately-owned reactors. Prices, which determine the dimensions of rental charges and fuel costs, are set by government fiat and may be guaranteed for only a limited period. Fuel may be withdrawn at any moment for emergencies. At present, the price of fuel is a classified item of information available only to properly "cleared" persons. In these circumstances the "ground rules" for analyzing and evaluating comparative fuel costs are patently unclear and uncertain.

(3) *Fuel Processing Costs.* At present, processing of solid fuel elements and reprocessing of partly spent fuel elements is also a government monopoly. Prices charged, which fix this important component of nuclear fuel costs, are likewise determinable by government fiat, rather that by competitive free enterprise. Hence, in these circumstances too an evaluation of comparative fuel costs becomes very speculative until some experience is had or the fuel handling monopoly is given up.

(4) *Depreciation.* Because of the higher investment cost of the reactor portion of an atomic power plant than the boiler section of a conventional fuel plant, the depreciation of the reactor becomes a very significant, and debatable, element of cost which will have to await experience to give bases for reliable estimates. We simply do not know whether the reactor will remain operable and serviceable for as long as the conventional part of the power plant, whether the core assembly portion may have to be replaced more than once in the over-all plant service life, how long a service life to assign to government-owned fuel inventory in the reactor, if necessary at all, or the extent to which obsolescence—presumably a major component of depreciation in these early stages of the new nuclear technology—will dominate service-life.

(5) *Exclusion Factor.* Because of the public hazard of radioactive exposure if something goes wrong with a reactor, much has been written or said about locating plants in remote places to minimize the risk, and presumably thereby to reduce public or employee liability insurance costs. Exclusion loads an adverse cost factor on an electric system because of the extra investment and costs of transmitting electric power from the reactor plant to load centers or existing transmission systems. No cost comparison we have yet seen makes allowance for this factor, though clearly it should enter into a utility system's evaluation of whether to go ahead with a conventional-fuel power plant addition or with an atomic power reactor plant—assuming, of course, some kind of firm-price reactor proposal can be obtained from an equipment manufacturer to compare with a similar proposal for equipment using conventional fuels. Such firm-price proposals, if they have yet been made, have not come to our notice, except in APPR.

Our brief reference to these five cost factors does not pretend to exhaust these factors or similar ones that might be mentioned. They are referred to only to show areas in which economic analysis and development of "ground rules" and cost estimating techniques should go hand in hand with the developing reactor technology. This is especially important if utility managements are to have the tools for judging when, in the interests of both investors and consumers, a plunge into the new technology may reasonably be made.

An Over-All View

Based on such cost considerations, the early nuclear fuel plants will be economically feasible only in a few relatively high-cost fuel areas in the United States, such as New England, for example, and in foreign countries which do not have fuel supplies and costs as favorable as those in this country.

There is already considerable agitation to prevent the use of nuclear fuels by private industry and to limit their application to "public power" projects. The inadequacy of elevated water supply in the TVA area, for example, means that the TVA must find other sources of raw energy if it is to remain in the power supply business when faced with increasing service demands. The proposal to build nuclear power plants with risk capital is opposed on the grounds that this is another "giveaway" program in which only a few of the citizens will reap the benefits of the vast expenditures made by all the people through the instrumentality of the Atomic Energy Commission. It is asserted that this store-house of nuclear knowledge is the property and right of all the citizens and should not be appropriated or diverted or "given away" for the benefit of the few. If government subsidy to "public power" projects is allowed to prevail in the support of nuclear power development, the true economic picture on the real costs of power will be greatly confused and retarded. Exact and rigorous comparisons can only be obtained when all plans must meet the test of the tax-paying market place.

Various estimates are now being made as to the rapidity with which nuclear power technology will develop. On the one hand, there are optimistic estimates which expect that as much as 50% of the new capacity being installed by 1975 will be nuclear. On the less optimistic side, there are estimates which say that not more than 3.5% of the total installed generating capacity of the nation will be nuclear by 1975. It will thus be seen that the impact of this developing nuclear power technology upon obsolescence of existing and future investment will be considerably diluted and will develop in time at a pace which will enable the directors of a company to take suitable steps to protect the integrity of past investments and at the same time take advantage of new power production technology.

Economics and the Public Interest

By L. G. HINES*

ALTHOUGH the role of government in economic life has vastly increased in importance during the past half century, recent developments in methodology and welfare economics have generally counseled retreat from questions of public policy. It is the purpose of this paper to show (1) that a consideration of the nature of the public interest is one of the neglected but essential functions of the economist; (2) that the determination of the public interest requires an appraisal of factors—such as political and administrative forces—that are generally considered outside the immediate scope of economics; and (3) that, in order for economists to contribute significantly to policy determination, the difficult problem of formulating a positive concept of "welfare" or "public interest" must be faced.

I

The former distinction between pure and welfare economics, based upon normative character of the latter division, has lost virtually all relevance with the rise of the new welfare school. The reluctance of the new welfare school to employ the utility approach in cases involving inter-personal comparisons of utility has permitted escape from the more obvious explicit value judgments, but at the expense of severely restricting the area of analysis.[1] If it is impossible to determine whether a given policy brings greater satisfaction for one group in society than dissatisfaction for another group, a familiar and useful approach to social problems must be discarded. If in addition it is impossible to measure and compare the effects upon different individuals of a given policy, little concrete policy advice can be given by the economist—as an economist—so long as the standard for determining policy is confined to individual desires or satisfactions.[2] The scientific unreliability of policy recommendations based upon the interpersonal comparison of utility—or "satisfactions," "happiness," "desiredness," or whatever term economists use in an attempt to escape hedonistic implications—has frustrated the application of economic analysis just short of the consideration of many pressing social issues.

The search for value-free analysis has partly been the result of increasing dissatisfaction with cardinal measurement of utility. Although Pareto pioneered in the development of an ordinal concept of utility, or *ophélimité*, his work had little immediate influence upon the English branch of the subject. English economists, including Edgeworth who made significant contributions to the development of indifference-curve analysis, accepted with little reservation the assumption of inter-personal comparison of utility in analyzing specific economic problems, whereas in the fields of public finance and taxation, policy recommendations were based on theories of sacrifice and benefit, which in turn

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[1] For a provocative criticism of the new welfare approach, see I. M. D. Little, *A Critique of Welfare Economics* (Oxford: Clarendon Press, 1950). See also, J. M. Clark, "Aims of Economic Life As Seen By Economists," *Goals of Economic Life* (New York: Harper, 1953), p. 40.

[2] ". . . . If the incomparability of utility to different individuals is strictly pressed, not only are the prescriptions of the welfare school ruled out, but all prescriptions whatever. The economist as an adviser is completely stultified, and, unless his speculations be regarded as of paramount aesthetic value, he had better be suppressed completely." R. F. Harrod, "Scope and Methods of Economics," *Economic Journal*, September 1938, p. 383. See also, I. M. D. Little, "The Foundations of Welfare Economics," *Oxford Economic Papers*, Vol. 1, (N.S.), June 1949, pp. 227, 242, 243.

rested firmly upon utility doctrine. During a later period, the emergence of the welfare school under the leadership of Pigou[3] made extensive use of utility analysis, and this approach still persists in such contemporary works as Lerner's *Economics of Control*.[4] The re-emphasis by Hicks and Allen[5] of the pitfalls of interpersonal comparison of utility and the trenchent statement by Lionel Robbins[6] of the need to free economics from value judgments did much to stimulate a reexamination of the normative branch of economics, setting the stage for the development of the new welfare school.

Even if one accepts the desirability of casting out the old for the new, however, two important problems remain: First, assuming that it is possible to determine correctly society's wishes on policy matters, does it follow that the function of the economist is solely to formulate means by which these given desires can be attained? In other words, is economics to be restricted purely to the question of means, assuming given ends, or is normative analysis necessary in order to provide full scope for the exercise of the economist's specialization.[7] Second, in appraising what society desires is it either particularly useful or sufficiently accurate to cast the goals of economic behavior into such broad categories as "satisfactions" or "happiness"?

Economists to a greater extent than other social scientists are divided into rival camps over the issue of value judgments: those who contend that nonnormative economics is unthinkable, undesirable, and impossible; and those who believe that economists, partly by relying upon the "impersonal" data of the market, can largely escape the burden of considering the nature of the ends of economic activity. It should be recognized, however, that even those who inveigh most vigorously against value judgments in economics reserve the right and presumably favor the expression of opinion by the economist as an individual, but *not* as an economist.[8] Although one may question whether such intellectual bifurcation is possible, or whether the public will be able to distinguish between the utterances of the "economist" and those of the "citizen," a more fundamental issue is raised by

[3] A. C. Pigou, *The Economics of Welfare* (1st ed., 1920; 4th ed., 1932; Lonon: Macmillan.)

[4] A. Lerner, *The Economics of Control* (New York: Macmillan, 1944).

[5] J. R. Hicks and R. G. D. Allen, "A Reconsideration of the Theory of Value," *Economica*, (N.S.), February 1934, p. 52.

[6] L. Robbins, *An Essay on the Nature and Significance of Economic Science*, (2nd ed., London: Macmillan, 1935). Apparently, however, Robbins' early work represented an overstatement of his views. He comments: ". . . . I confess I was very surprised when I found myself held up as advocating for economists the impossible and sterile virtue of never attempting to apply their conclusions—rapt astronomers of the social universe designing no aid to navigators in search of the desired haven. All that I had intended —and it was certainly possible to cite the most explicit statements to this effect—was that they might better realize the exact connections between the normative and the positive, and that their practice as political philosophers might be made thereby more self-conscious." ("Inter-personal Comparisons of Utility: A Comment," *Economic Journal*, December 1948, p. 640.)

[7] "The theorist's analysis is ordinarily couched in descriptive as distinguished from normative terms. If choices as between social values influence his thought, these choices are largely left implicit in his selection of premises, and are rarely, and then usually apologetically, expressly avowed. The policy-maker, however, is rarely satisfied with purely descriptive analysis. He insists that he be advised not only what will be the objective consequences of a specific line of action, but whether or not these are desirable consequences. While he has always some notions of his own with respect to the values which policy should serve, in my experience he always demands of his economists that they guide him also in the determination of what is socially desirable, and he expects the economist to acknowledge and to display some professional competence in giving such guidance." (J. Viner, "Short and Long View in Economic Policy," *American Economic Review*, March 1940, p. 2.) See also, R. F. Harrod, *op. cit.*, pp. 391, 395, 410-11.

[8] The reasoning involved here becomes more than a little strained and is responsible for the frequent distinctions in the literature that what is improper for the economist *qua* economist is quite proper (and praiseworthy) for the economist *qua* citizen. The reasoning is strained because the economist's opportunity to express his opinions as a citizen and the recognition given to his views may be due largely to his professional status as an economist.

such a standard of professional conduct: Is it possible for the economist to perform his function satisfactorily—as it conceivably may be for the physician or engineer—irrespective of the nature of the social system and its goals? In other words, is the economist primarily a technician, or is he something more.[9] This problem is not apparent in those instances where normative considerations are not involved in the analysis or where the economist's standards of value coincide with the accepted or enforced social code. But what of the welfare economist? Is not his function to appraise the nature of social net product as well as the conditions promoting its maximization? And will not his effectiveness be severely delimited by automatically accepting existing social mores? Or put another way: Can the economist maintain professional respectability by serving as an uncritical handmaiden of the majority interest?[10] Has the economist adequately performed his function if he confines his attention to such projects as devising means by which taxes can be reduced, expenditures curtailed, demobilization speeded, or international trade restricted—simply because at times the public strongly favors such objectives? On the basis of past performance the economist has clearly refused to accept such a limited view of his function.[11] But in any case the uncritical acceptance of either individual or social goals does not automatically insure value-free neutrality in analysis. At best such a practice simply neglects the question of the legitimacy of the goal; at worst, it tends to convey approval by default.[12]

Ignoring for the moment, however, the problem of appraising social goals (and measurement), does the summation of individual satisfactions provide an adequate criterion of public interest? As a convenient theoretical short-cut, "satisfactions" is a troublesome but necessary common denominator of human motivation. Its use permits comparability of ends and obviates the tedious and generally unenlightening process of specifying the many objectives that are responsible for economic activity. At the same time, by limiting analysis to the description of human behavior and refusing to inquire into motivation, the economist confines his investigation to a more nearly manageable portion of behavior and avoids the manifold conflicts and confusions of a psychological interpretation.[13]

As with most general concepts, however, "satisfactions" is subject to a variety of interpretations. When economists specify what is meant by "satisfactions" they sometimes come perilously close to reintroducing a hedonistic interpretation, which it is one of the purposes of the term to avoid. Frequently, as with Pigou, the term is defined by what it does *not* include or imply, rather than what it does cover. Thus Pigou, after identifying an individual's welfare with satisfactions, asks:

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[9] See T. Scitovsky, "The State of Welfare Economics," *American Economic Review*, June 1951, p. 305.

[10] See C. I.. Allen, "Modern Welfare Economics and Public Policy," *Southern Economic Journal*, July 1952, p. 34.

[11] In spite of the recent preoccupation with the problem of value-free analysis, economics has a vigorous heritage of active interest in public policy. See the excellent study of L. Robbins, *The Theory of Economic Policy in English Classical Political Economy* (London: Macmillan, 1952).

[12] See J. M. Clark, "Toward A Concept of Social Value," *Preface to Social Economics* (New York: Farrar & Rinehart: 1936), p. 44; R. G. Hawtrey, *The Economic Problem* (London, Longmans, Green, 1925), p. 187 *et seq*; A. L. Macfie, *Economic Efficiency and Social Welfare* (London: Oxford University Press, 1943); and W. A. Weisskopf, "Hidden Value Conflicts in Economic Thought," *Ethics*, April 1951, p. 195.

[13] Needless to say, suggestions and attempts to supplement economic analysis by a psychological interpretation of behavior have appeared in the literature. On the whole, however, such endeavors have been neither particularly successful nor especially original. See, for example, G. Katona, *Psychological Analysis of Economic Behavior* (New York : McGraw-Hill, 1951).

"But what does satisfaction mean? Not simply happiness or pleasure; for a man's desires may be directed to other things than these and may be satisfied. It might seem that, when his desire attitude is given, his satisfaction depends straightforwardly on the extent to which his desires are fulfilled. But the satisfaction yielded when a desire is satisfied does not always bear the same proportion to the intensity of the desire. Not only may people make mistakes, desiring certain objects in the hope of satisfactions which they do not in fact yield, but also as Sidgwick observed, 'I do not judge pleasures to be greater or less exactly in proportion as they exercise more or less influence in stimulating the will to actions likely to sustain or produce them.' Some economists, neglecting this point, have employed the term 'utility' indifferently for satisfactions and for desiredness. I shall employ it here to mean satisfactions, so that we may say that a man's economic welfare is made up of his utilities.[14]

One of the minor difficulties with the term "satisfactions" is that it is too readily identified with the condition of relaxation following the completion of some physiological process. Actually, of course, the term is sufficiently nonspecific to cover the entire range of human behavior, including social as well as individual goal achievement. The latter has received the greater attention in most economic studies because of the key roles—as producers and consumers— assigned to the individual in orthodox theory. It is abundantly apparent, however, that the individual's desires and demands are in many cases socially-conditioned and socially-determined, and that the influence of social distinction and opprobrium becomes more pronounced as the standard of living is raised. In short, the individual is likely to conclude that he is well-off or poorly-off, not by reference to an abstract standard, but by comparison of his position with that of others in society.[15]

Thus, although inter-personal measurement of satisfactions is not possible, it is a safe first approximation to conclude that unresolved tensions and unfulfilled desires will be experienced by those who consider their social rewards—in terms of income, prestige, and the like—to be deficient in comparison with similar rewards of other individuals, both within their own social strata and in relation to other groups. This point is of critical importance for the formulation of a welfare concept based on the sum of individual satisfactions since it indicates that such a standard is likely to be a shifting and tenuous measure, depending not alone upon changes occurring in any given individual's complex of commodities and emoluments, but also upon similar changes for the rest of society.[16]

In spite of the shifting nature of individual satisfactions (and aspirations), it

[14] A. C. Pigou, "Some Aspects of Welfare Economics," *American Economic Review*, June 1951, pp. 288-9. Hawtrey is critical of this position, saying, "In identifying welfare with satisfactions, Professor Pigou is implicitly assuming in the individual a disposition to prefer the greater good, just as the hedonist assumed a disposition to prefer the greater pleasure. The former assumption is no closer approximation to the truth than the latter, and we cannot adopt it." (R. G. Hawtrey, *The Economic Problem*, p. 184.) See also *ibid.*, pp. 184-89, and Hawtrey, *Economic Destiny* (London: Longmans, Green, 1944), chaps. 12 and 13. Hobson, however,—with some important reservations—identified welfare with satisfactions. J. A. Hobson, *Economic and Ethics: A Study in Social Values* (Boston: Health, 1929), pp. 16-17. A critical re-examination of the validity of the assumption of individual maximization of satisfaction is found in C. Sutton, "The Relation between Economic Theory and Economic Policy," *Economic Journal*, (March 1937, p. 44.)

[15] ". . . . It is personal relations that really hurt; relative poverty and supposed 'injustice,' particularly humilation, are worse than actual privation." (F. H. Knight, "Economic and Social Policy in Democratic Society," *Journal of Political Economy*, December 1950, p. 518.

[16] An approach to this position may be implicit in Scitovsky's criticism of Kaldor and Hicks' use of the compensation technique. He says: "Mr. Kaldor and Professor Hicks have asserted that it is *always* possible to tell whether a given change improves general welfare, even if not all people gain by it and some lose. The test suggested by them: to see whether it is possible after the change fully to compensate the losers at a cost to those favoured that falls short of their total gain, is fundamentally identical with the first two of our criteria. The objection to using this criterion by itself is that it is asymetrical, *because it attributes undue importance to the particular distribution of welfare obtaining before the contemplated change . . . . there can be no justification in attaching greater importance to the welfare distribution as it was before than it is after the change.*" T. de Scitovsky, "A Note on Welfare Propositions in Economics," *Review of Economic Studies*, 1943, p. 88. Second italics added.

may be possible to devise a semi-objective means of assessing individual reactions to specific welfare proposals. If welfare is to be identified solely with the maximization of individuals' satisfactions, the problem of establishing suitable standards becomes largely a process of gathering information. Sampling studies may be employed to measure various degrees of approval or hostility to a given welfare policy. Such a procedure, although content with cruder results than those expected from the utility approach, would still encounter difficulties, aside from the problems of devising a satisfactory sampling technique, because of the frequent inadequacy of public knowledge essential for rational response.[17]

As unsatisfactory as such a method of determining public preferences or satisfactions may appear, this problem must be faced by those economists who are really serious in their insistence on neutrality in policy considerations. It should be apparent, however, that by accepting such a standard as that suggested by Pigou and others, economists also accept the misconceptions and errors or judgment, the lack of knowledge, prejudice, and general indifference that influence the opinions of any diverse group of individuals. In some cases this may be a reasonable price to pay for the preservation of the freedom and dignity of the individual; in other instances it may impose intolerable barriers to the determination of the true public interest as well as the achievement of efficient public administration.

II

One of the perplexing problems of welfare analysis is to bridge the gap between individual objectives and social goals. The traditional economic approach to this problem has been to assume that the simple summation of individual satisfactions will coincide with the public interest. From the standpoint of either the economic or political process, however, such an assumption appears to be unwarranted.[18] Aside from possible structural obstacles to the attainment of ideal resource allocation, two major factors stand in the way of ethical approval of the results of the marketing mechanism: (1) income and wealth inequality and (2) incomplete and faulty knowledge. Inequality in control over resources may stimulate aggregate output but distort the pattern of production from that of an ideal based upon the wishes of all members of society, whereas inadequate knowledge decreases the likelihood of rational consumer choice and increases the dependence of the consumer upon the producer.

The political process is subject to much the same type of criticism so far as the attainment of ideal social legislation is concerned. The public issue that arouses the typical individual from apathy is the one that affects him directly and particularly, instead of indirectly

[17] This problem consists of two parts: lack of information and lack of opinion. Both are disastrous for policy formulation, but the former seems at times to indicate more dramatically the futility of relying solely on public opinion as a guide to policy. For example, according to compilations reported in the *Public Opinion Quarterly*, as of December, 1948, 21 percent of a selected sample had not read or heard of the civil war in China; and as of January 30, 1949, 36 percent had not heard or read of the House Un-American Activities Committee. Cited by A. R. Oxenfeldt, *Economic Systems in Action* (New York: Rinehart, 1952), pp. 47-48, n. 32. With respect to the question of opinion, a British Institute Public Opinion poll taken in November 1950, asked whether the individual thought government operation was good, bad, or had no opinion in five cases of nationalization. "No opinion" ran from a low of 7 percent in the case of "medical services" to a high of 33 percent in the case of "road transportation." The lower percentage of "no opinion" in the case of medical services may be explained by the more direct contact the British citizen has had with this function and the considerable publicity given to this issue. M. Strunck, "The Quarter's Polls," *Public Opinion Quarterly*, Spring 1951, p. 172.

[18] This is not to infer than the optimum social welfare somehow transcends the interest of the very individuals who are the basis of social organizations, but to suggest that the vigorous but random expressions of interest groups cannot be expected to add up to the general social welfare or the public interest.

and generally along with the multitude of other citizens. His interest as a farmer, unionist, or business man—or subdivisions within these groups—usually calls forth his most vigorous efforts to protect and advance his position. Since individuals are inclined to be more articulate in the promotion of their special interests in contrast to their general interests as members of society, is there any reason to assume that the aggregating of such special interests will somehow balance so that the general welfare or public interest will be maximized? Many national and international problems of public policy, although of transcending importance, are too remote from the individual's small influence upon policy to justify the prolonged attention and study that may be necessary to reach *any* conclusion, let alone a "sound" conclusion.

The basic first step in this problem is to determine what the "public interest"[19] or "general welfare" actually is. The term *public* is itself illusive, and one must guard against endowing it with special characteristics of a somewhat mystical or overly organic nature. Hobson comes close to the organic interpretation in attributing to society a special psychical character:

> ". . . . we have laid stress upon those classes of social activities and phenomena where co-operation and interaction of private interests and purposes so modify and alter their nature and working as to give to that co-operation and interaction a special psychical character akin to personality. Thus regarded, community is not merely a set of social institutions and activities, but in effect a collective personality, a partial fusing of the individual minds and purposes in what may be termed a federal unity. If individuals utilize community in order to realize their material and spiritual aims, so does community use individuals to realize the common life."[20]

Although instances can be cited to support the belief in the organic purposefulness of society, such an interpretation runs the risk of over-emphasizing the extent of harmony that exists in society and the ease of attaining the public interest. Undoubtedly society does act with a harmony and unity of purpose in those instances where adequate consensus is attained. The fact that division in society occurs, sometimes permitting established practices and customs to be overthrown and at other times stalemating positive action, indicates that the organic unity of society is subject to realignment as well as occasional disintegration. Generally, however, the presence of abundant consensus—although not necessarily a reflection of accurate determination of public interest—leaves little doubt concerning the public desire and less opportunity of persuading it to reverse its position.

[19] The phrase "affected with the public interest," which has played such an important role in public utility regulation, was apparently first used by Sir Matthew Hale, Lord Chief Justice of the King's Bench of England, in an essay, *De Portibus Maris*, (*circa* 1670) published in 1787 by Francis Hargrave, an English barrister. Lord Hale contended that "if the king or subject have a public wharf, unto which all persons that come to that port must come and unlade or lade their goods as for the purpose, because they are the wharfs only licensed by the queen, according to the statute of I. El. cap. II. or because there is no other wharf in that part, as it may fall out where a port is newly erected; in that case there cannot be taken arbitrary and excessive duties for cranage, wharfage, pesage, etc. neither can they be inhanced to an immoderate rate, but the duties must be reasonable and moderate, though settled by the king's license or charter. For now the wharf and crane and other conveniences are affected with a publick interest, and they cease to be *juris privati* only; as if a man set out a street in new building on his own land, it is now no longer bare private interest, but is affected with a publick interest." F. Hargrave, *Collection of Tracts Relative to the Law of England* London: 1787, pp. 77-78. Cited by B. P. McAllister, "Lord Hale and Business Affected with a Public Interest," *Harvard Law Review*, March 1930, p. 764. For the use of the concept of public interest by quasi-judicial regulatory agencies, see R. W. Habeson, "The Public Interest Concept in Law and Economics," *Michigan Law Review*, December 1938, p. 181, and M. M. Jansky, "An Analysis of the Standard of Public Interest, Convenience, and Necessity As Defined by the Federal Communications Commission," *George Washington Law Review*, November 1937, p. 21.

[20] J. A. Hobson, *Economics and Ethics: A Study in Social Values* (Boston: Heath, 1929); also published under the title, *Wealth and Life: A Study in Values* (London: Macmillan, 1929), p. 167. See also *ibid.*, pp. 31, 32, 68, and the review article on this work by A. B. Wolfe, "On the Content of Welfare," *American Economic Review*, June 1931, especially p. 212.

It is in those instances where there is not workable consensus either as a result of lack of opinion or because of conflicting policies advocated by different groups that the role of the economist is consequently of greater importance. Lack of opinion may be due to public apathy, incomplete knowledge, or the excessively technical nature of the issue, whereas inadequate consensus is generally the result of division of opinion such as may be produced by conflicts of various interest groups. In only rare cases of virtually unanimous concensus is there such a thing as *the* public as an organic unit. Generally there are as many "publics" as there are active interest groups, each striving with varying degrees of success to sanctify its actions by masquerading as the true defender of the public interest.[21]

Events, such as strikes in essential industries, that greatly disrupt the normal pattern of the social and economic activity of the community attract the greatest public attention, but hardly the balanced and careful consideration that may be required to determine the true public interest. In addition, the urgency of the solution of such issues frequently decreases the likelihood of just settlement of the dispute, since termination of the disruption becomes more important than the equity of the settlement.[22] On the other hand, the public is inclined to ignore or overlook less dramatic disruptions to its routine and issues in which the effect is indirect or distant. Bias in determining the public interest may occur in both instances.[23]

So far we have treated public interest as identical with the desires or satisfactions of the public, requiring only the expression of the "collective will" to disclose the appropriate public policy. But such a view of public interest is a deceptive oversimplification of the problem. It is based on the popular, and possibly necessary, fictions that (1) the electorate in a democracy is not simply a residuum of political control, but an active agency for the determination of policy, and (2) the expression of the will of the majority on virtually all issues is the sole *modus operandi* of democratic government. The frequent acceptance by economists of this somewhat naive view of the democratic process is partly responsible for the iteration of the distinction between the economist *qua* economist and *qua* citizen. The citizen-sovereignty doctrine is untenable, not because it represents an unsound ideal, but because it is a useless distortion of reality. The informed and articulate citizen is a

[21] J. Dewey, *The Public and Its Problems* (New York: Holt, 1927; reprinted by Gateway Books, Chicago, 1946), chap. 1, and pp. 117, 134, 137, 147; W. Lippmann, *The Phantom Public* (New York: Harcourt, Brace, 1925), pp. 106, 111, 112-113. Lippmann considers special interest to be spurious elements in the public. ". . . . The true public, in my definition of the term, has to purge itself of the self-interest groups who become confused with it. It must purge itself not because private interests are bad but because private interests cannot successfully be adjusted to each other if any one of them acquires a counterfeit strength. If the true public, concerned only in the fact of adjustment, becomes mobilized behind a private interest seeking to prevail, the adjustment is false; it does not represent the real balance of forces in the affair and the solution will break down." (*Ibid.*, pp. 112-13.) See also R. B. Dishman, "The Public Interest in Emergency Labor Disputes," *American Political Science Review*, December 1951, pp. 1101-03. For a different view of the role of special interests in our political and economic life, see J. K. Galbraith, *American Capitalism: The Concept of Countervailing Power* (Boston: Houghton, Mifflin, 1952),, especially pp. 169-70.

[22] Dishman emphasizes the "public interest" primarily in terms of urgency of settlement. He says: 'To put the point a little more precisely than perhaps the facts warrant, the public's interest in a soft-coal strike would seem after sixty days to equal its interest at any time in a general railroad strike. The same point can be made, with some greater reservations, of strikes in the oil, copper, and maritime industries." (*Op. cit.*, p. 1107.)

[23] A number of reasons may be listed for public apathy to important issues, but undoubtedly one of the most important is that most individuals find it impossible to obtain and maintain the degree of information and understanding necessary to reach conclusions on many public problems. This limitation applies not only to the so-called average citizen, but also to the elected representative. See P. H. Appleby, *Policy and Administration* (University, Ala.: University of Alabama Press, 1949), p. 126, for an illustration of how a complex and ambiguous statement of the procedure of determining minimum electrical rates at reclamation projects resulted in diverse interpretations.

mythical creation[24] that has neither the methodological usefulness nor the partial foundation in fact enjoyed by the overly-maligned concept of the economic man.

At best the public can supply only general direction to its elected representatives and occasional counsel on isolated issues.[25] An important part of policy determination takes place outside the range of the direct control by citizens—even the most articulate and informed citizens. "Policy" and "administration" are not completely independent functions if for no other reason than the impossibility of prior specification of policy for all problems likely to be encountered by the administrator.[26] A considerable part of public policy is determined *during* the process of administration, since neither the general public nor its representatives can be expected to possess the knowledge and foresight to anticipate the many policy decisions required of the bureaucracy.[27]

The lack of clear-cut cleavage between the administrative and policy functions of government has been greatly emphasized by the expansion of governmental activities since the Depression of 1932. As long as the predominant function of the bureaucracy was primarily the enforcement of well-established regulatory acts, the policy-making aspects of administration—although present—were of relatively minor importance. Legislation during the 1930's, however, created new government functions as well as sharply increasing the activities of existing agencies. As a result, at least two factors disturbed the previous administrative—policy-making balance: (1) the problem of timing of such things as public works, fiscal policy, and price control sometimes did not permit prior public consideration,[28] and (2) even when time for consideration was available, the technical nature of the issues discouraged widespread public response. In some cases the increased technicality of public problems has encouraged the substitution of extremely general issues, such as that of "bureaucracy" and "socialism," in place of specific technical problems. Possibly the greatest disservice of the politician is the growing tendency to present public issues

[24] ". . . . At best, responsibility in a democracy will remain fragmentary because of the indistinct voice of the principal whose agents the officials are supposed to be—the vast heterogeneous masses composing the people. Even the greatest faith in the common man . . . . cannot any longer justify a simple acceptance of the mythology of 'the will of the people'." C. J. Friedrich, "Public Policy and the Nature of Administrative Responsibility," *Public Policy* (C. J. Friedrich and E. S. Mason, eds., Cambridge: Harvard University Press, 1940), p. 24. See, however, Herman Finer's criticism of this article under the title of "Administrative Responsibility in Democratic Government," *Public Administration Review*, Summer 1941, p. 335.

[25] Lasswell believes that for the first time in the history of large-scale social organizations, sampling procedures and opinion polls may provide the means of realizing the aims of democracy through making available the views of the public to the elected representatives and government officials. H. D. Lasswell, "The Relation of Ideological Intelligence to Public Policy," *Ethics*, October 1942, p. 27. This is, however, just half—and probably the less important half—of the problem. Quick interviews may reveal the attitudes of different groups on various issues; they cannot stimulate the interest and provide the knowledge necessary for public determination of policy.

[26] See the excellent review articles on writings in administrative theory by J. M. Gaus, "Trends in the Theory of Public Administration," *Public Administration Review*, Summer 1950, p. 161, and W. S. Sayre, "Trends of A Decade in Administrative Values," *ibid.*, Winter 1951, p. 1. These articles contain appraisals of the major contributions to this field that have appeared in the *Public Administration Review* since its inception. See also A. J. Boudreau, "Public Administration and the Public Interest," *Canadian Journal of Economics and Political Science*, 1950, p. 371; J. M. Gaus, "The Responsibility of Public Administration," *The Frontiers of Public Administration* (Chicago: University of Chicago Press, 1936); E. P. Herring, *Public Administration and the Public Interest* (New York: McGraw-Hill, 1936); and H. A. Simon, *Administrative Behavior: A Study of Decision Making* (New York: Macmillan, 1947).

[27] The distinction between politics and administration, or policy-making and execution, that characterized much of the early approach to public administration is well illustrated by F. J. Goodnow, *Politics and Administration* (New York: Macmillan, 1900). Although such a distinction provides a useful introduction to the topic of administration, the division is arbitrary and unrealistic when carried to its logical conclusion. See especially the comments of C. J. Friedrich, "Public Policy and the Nature of Administrative Responsibility," *op. cit.*, p. 5 ff.

[28] At the same time, the increase in government functions —especially at the federal level—has afforded greater opportunity to pressure groups to influence legislation and administration. See E. P. Herring, "The Politics of Fiscal Policy," *Yale Law Journal*, March 1938, p. 724.

in terms that encourage response at the expense of understanding. It is generally conceded that the economist, either as a teacher or writer, is performing a desirable function when he aids the public in reaching well-informed decisions. But the economist's obligation to the public would appear to be even greater in those instances where because lack of time or technical knowledge, the public must allow the policy function to pass at least temporarily from its control.

III

If the above view is accepted, it follows that more careful consideration of the nature of public interest and economic goals of society is required. Economists have frequently bypassed this problem on the ground that the public interest defies objective measurement and agreement.[29] Implicitly or explicity, however, economists have posited goals, such as maximization of income, when discussing the operation of the economic system. It is but a short step from the goal of income maximization to such objectives as provision for future productivity and progress.[30] Such goals, although essentially nonspecific, are illustrative of the standards that economists have employed in analysis in the past. Although generally accepting the principle of maximization in the study of production, economists have shown much less enthusiasm for positing distributive goals, even though the goal of income maximization carries the assumption that (1) the individual's work-leisure balance (and hence income-leisure balance) is personally satisfactory, and (2) changes in aggregate income do not cause individual disaffection as a result of a new pattern of production and distribution.

Perhaps the recent discussion of the "optimum population" most clearly illustrates the need to include consideration of distributive aspects in the development of a concept of public interest. Neither population per se nor income per se can be accepted as the sole goal of society, and to the extent that other factors are important they must be reflected in the concept of optimum population. As a result, the formulation of this concept represents a special case in the determination of public interest. Economists, however, have generally confined their analysis to the economic effects of population change, with varying recognition given to non-economic factors.[31] Although at first glance such delimitation may appear desirable to obtain the advantages of specialization in research, by

[29] Possibly the extreme expression of this view is found, strangely enough, in a recent publication of Roy Blough, formerly a member of the President's Council of Economic Advisers. He says: "The author does not look on the public interest as something that can be objectively determined or measured. It is, rather, a highly individual view of what makes the 'good society.' It is the gleam in a man's eye of the way to promote a better world. . . ." R. Blough, *The Federal Taxing Process* (New York: Prentice-Hall, 1952),pp. 7-8. See also E. P. Herring, *Public Administration and the Public Interest*, pp. 23-4; I. M. D. Little, "The Economist and the State," *Review of Economic Studies*, 1949, pp. 75-6, and *A Critique of Welfare Economics*, chaps. 3, 5, and 14; H. Myint, *Theories of Welfare Economics*, pp. xi, 225, 235; A. Radomysler, "Welfare Economics and Economic Policy," *Economica*, (N.S.), August 1946, pp. 201-02; H. R. Smith, "The Role of Science in the Formulation of Economic Policy." *Southern Economic Journal*, April 1949, pp. 333, 340; and A. B. Wolfe, "On the Concept of Welfare," *American Economic Review*, June 1931, pp. 209, 210, 217, and "On the Criterion of Optimum Population," *American Journal of Sociology*, March 1934, pp. 588, 594-5, and 599.

[30] It is interesting to note that F. H. Knight, in his admirable elementary text on the economic process, defined "progress" as an amoral concept, although he says that "it is a matter of standards or values to decide how much progress society can afford or cares to have at the cost of sacrificing present values . . . ." F. H. Knight, *The Economic Organization* (Chicago: University of Chicago, 1933), pp. 10-14.

[31] See H. Dalton, "The Theory of Population," *Economica*, March 1928, p. 28; M. Gottlieb, "The Theory of Optimum Population for A Closed Economy," *Journal of Political Economy*, December 1945, p. 296; E. F. Penrose, *Population Theories and Their Application* (Stanford: Food Research Institute, 1934), chaps. 2 and 3, and especially pp. 74 ff for criticism of the income concept of population optimum; L. Robbins, "The Optimum Theory of Population," *London Essays in Economics in Honour of Edwin Cannan* (T. E. Gregory and H. Dalton, eds., London: Routledge, 1927), p. 120; A. B. Wolfe, "On the Criterion of Optimum Population," *op. cit.*, p. 588.

the very nature of the problem of selecting an *optimum*, no one factor—such as income—can be considered to the exclusion of others. In addition, by concentrating upon the income facet alone, changes in either population or income raise the familiar problem of interpersonal comparison of satisfactions unless the optimum is to be a purely mechanistic index of productivity.[32]

As in the case of the formulation of a comprehensive concept of the public interest, the population optimum must encompass more than selected aspects of the population problem. In short, well-rounded treatment requires additional analysis, although not necessarily by the economist, to determine: (1) whether the income distribution following a change in population is more or less desirable than previously; (2) what non-income changes occur as a result of population change; and (3) whether population changes raise normative problems even though society may not recognize them as such. This third point involves the familiar task of appraising social goals, which is the very heart of the problem of the determination of the public interest and selecting an optimum population concept.

The interrelationship of these concepts may be illustrated from the field of resource utilization. Given a restricted objective, such as accelerated defense mobilization, special arrangements may be desirable to modify the depletion rate of some resources and to encourage the discovery and development of additional sources of supply. In short-run analysis such changes are usually expressed in terms of the supply function of the resources in question, but for long-run analysis the population variable becomes an important constituent of the problem. Thus in its long-term, broad aspects, the population problem is essentially the welfare or public interest problem, and only in a narrow sense the economic problem: it involves the question of the influence upon welfare of the change in one or more of the factors of production.[33] In such a situation, the intrusion of the question of the public interest cannot be prevented, even though the public may not be conscious of the nature or importance of the issue, and failure to consider the welfare aspects results in inconclusive as well as inadequate treatment of the population problem.[34]

[32] Wolfe (p. 599) seems to adhere most closely to the productivity index of population optimum, whereas Dalton (p. 31) recognizes quite clearly that the economic optimum must answer the distributive question.

[33] Wolfe states the broad aspects of this problem as follows: ". . . . Once the people decide how hard and how long they want to work, and how rapidly they wish to exhaust their natural resources, there is, for any given state of the arts and any given available supply of resources an ideal distribution of resources between various industries. This is the balanced economy which, and only which, achieves the highest per capita output and the highest per capita real income." A. B. Wolfe, "Economy and Democracy," *op. cit.*, p. 1. It will be recognized that Wolfe's "highest output and income" is so by definition and assumption, rather than a statement of what could be achieved under various conditions. Actually, it is a statement of the optimum for a given arrangement as distinct from an optimum for society.

[34] Penrose goes beyond such restricted treatment in proposing a means of establishing a welfare criterion for population optimum. He says: "Welfare may be defined as an aggregate of attained desirabilities. The attainment of desirabilities requires, in varying degrees, the consumption of certain kinds of goods and services, and it is with this aspect of the matter that the student of economics is primarily concerned. It is fundamental to my position that an aggregate of realized actual individual desires for goods and services is not necessarily nor even probably identical with an aggregate of desirable goods and services." E. F. Penrose, *op. cit.*, p. 74. Penrose believes that what constitutes desirable goods and services must be determined, not by what the public indicates it wants, but from a consensus of specialists in different fields. ". . . . The consumer cannot be accepted as an adequate judge of the economic means of attaining maximum welfare for himself. These economic means must be judged as objectively as possible in light of the best available scientific knowledge of the times." (*Ibid.*, p. 86.) Depending upon one's view of the ethical desirability of consumer sovereignty and one's appraisal of how efficiently the pricing system functions, the above statements may bring either indignation or approval from social scientists. Clearly, however, this is the issue that must be faced, although by refusing to accept the consumer's judgment of what constitutes his own welfare it does not follow that the standards of the experts should be imposed by coercion, even—for example—by the amount of coercion present in private-enterprise advertising. In the same way that the analysis of any problem is incomplete until all reasonable alternative possibilities have been considered, so the determination of welfare or the public interest cannot rest solely upon expressed public opinion.

IV

We may conclude that the public interest, which may also be termed the social welfare optimum, is maximized when the goals achieved by society coincide with the "welfare standard," which must be a joint-product of society's wishes, supplemented by advice from specialists in those areas where the public is incapable of reaching informed conclusions. The criteria chosen can not be confined to the summation of individuals' desires because: (1) there are issues upon which the public has no opportunity to express its opinion; (2) there are issues about which the public has neither knowledge nor opinion; and (3) there are issues that cannot await public consideration.

There are three main areas in which economists along with other social scientists are under obligation to aid, by analysis leading to policy recommendation, in the determination of the public interest: (1) instances in which the pricing system fails to allocate costs properly; (2) situations where pricing-system direction of resources is not possible or desirable; and (3) occasions when the individualistic bias of the pricing system hinders or prevents the attainment of socially-desirable resource allocation.

Instances in which the pricing system fails to allocate costs properly are frequently the combined result of competitive forces and institutional practices, sometimes inadequately dismissed as "excesses" of competition. For example, in agriculture existing tenure arrangements may encourage a type of exploitative farming that is not only destructive of the soil through leaching and wind and water erosion, but also of adjacent and distant regions through dust and silt deposition. The loss in productivity to the adjacent and distant farms may greatly exceed the reduction in output of those farms where such practices are followed. To the extent that exploitative farming leads to the destruction of property rights of others, a special need for remedial and preventive action is raised, although even when such practices affect only the operator-owner in question society still has an interest in their prevention. Pollution of the air and water, destruction of animal resources, premature depletion of energy resources, and the impairment of human resources provide additional illustrations of areas in which social costs are frequently not levied upon the responsible private interess.[35]

Some medical services, education in general, police protection, and the variety of "public services" illustrate well-known situations where the pricing-system direction of resources is not in accord with existing social mores. The predominant characteristic of public-service activities seems to be the tendency to increase with social and economic progress. An allied but less apparent inadequacy of the pricing system is illustrated by the problems encountered in administering govermnent-owned land areas. In the case where such resources have a variety of uses, some of which are conflicting, the administrator may obtain only minor aid from the pricing system.[36] For example, government land in the western regions may serve a variety of purposes: recreation, grazing, mining, watershed, lumbering, irrigation, and reclamation. Conflicts may arise both over the method of allocation and between different uses; some activities, such as grazing and mining, may be destructive of other uses, such as recreation and watershed protection. Since the returns from some uses, especially those yielding predominantly public benefits, are frequently neither

[35] See K. W. Kapp, *The Social Costs of Private Enterprise* (Cambridge: Harvard University Press, 1950).

[36] See M. Clawson, "Administration of Federal Lands in the Public Interest," *Journal of Politics*, August 1951, p. 447.

numerically measurable nor readily comparable, it is the function of the administrator to determine and protect the public interest.[37] In many cases of this type, however, the pricing-system allocation of such resources represents an outright distortion of the public interest.

Finally, the operation of the pricing system is characterized by an individualistic bias well in excess of any existing cultural predilection. The public interest —and indeed, the individual interest—is not limited to *declared* individual objections but must include other objectives that are ignored because of lack of knowledge, time, and patience, or that are stifled through the absence of satisfactory means of expression. An individual's interest in obtaining (e.g.) a new automobile, although not necessarily greater than his apprehension over the fulfillment of the defense mobilization program, is by comparison so direct, tangible, and *by itself* represents such a fractional drain on national output that few individuals are likely voluntarily to curtail consumption because of concern over defense production. When such conflict occurs between private and public use of resources, the individual must be outbid by the authorized public agency or the unhampered operation of the pricing system must be modified by selective controls. In either case important policy considerations are involved in the choice of methods of achieving the public interest as well as in determining what this interest is. Quite obviously, however, the method chosen to attain such objectives is valid only to the extent that these objectives themselves promote the public interest.

[37] The new welfare test of policy based on whether the program in question increases national income sufficiently to compensate those injured by such a program is of little use in such cases. Two major objections may be raised to the compensation device: (1) the extent of the injury or loss may not be measurable; and (2) it may be socially undesirable to indemnify private interests under certain circumstances. For example, the restriction of public domain grazing privileges may injure private ranching interests in order to protect watersheds and to increase public recreational facilities. To the extent that the grazing practices of the past shifted part of the cost of operating a private undertaking to the public, no compensation—other than a possible terminal payment—would seem warranted in withdrawing this subsidy. *See* G. J. Stigler, "The New Welfare Economics," *American Economic Review*, June 1943, p. 355, for an amusing reductio ad absurdum of the compensation device.

Institutions, Ground Water, and Overdraft—An Aspect of Irrigated Agriculture†

By J. HERBERT SNYDER*

THE decline of ground-water levels over a long period of time is a cause for concern, particularly in arid areas. Over the last twelve years the Antelope Valley, located in southern California's Mojave Desert, has experienced declines that exceed fifty feet. Intensive irrigated agriculture, dependent upon pumped ground water, has drawn on the ground-water reservoir and lowered water levels. Ground-water mining—an excess of annual draft rate over annual recharge rate—has resulted and the Valley is subject to a condition of overdraft.[1]

Irrigated agriculture in Antelope Valley has, over the last decade, produced crops averaging more than $8,000,000 in value each year. Irrigated acreage has increased from 35,000 to more than 60,000 acres during the same period. Population has expanded from less than 10,000 persons in 1940 to more than 30,000 at the present time. Most of this increase has been in urban population.

On the other hand, average annual recharge to the Valley would support only 8,000 to 20,000 acres of irrigated crops—depending on the type of crop grown—without causing continued decline in ground-water levels. Contrasting agricultural with urban water requirements, it is estimated that this same flow resource could maintain an urban population of between 90,000 and 150,000 persons depending upon the type and extent of industrial development.

But Antelope Valley did not expand with an eye to this limited and highly variable flow resource. The availability of a seemingly limitless ground-water stock resource or ground-water reservoir —created from the flow resource—encouraged mining the resource. Continued declines in ground-water levels have resulted and overdraft is an acknowledged fact.

The Agricultural Research Study Committee of the California Legislature has stressed the need for study of water resource problems. The Giannini Foundation of Agricultural Economics has begun studies that emphasize economic aspects of ground-water problems.[2] This paper presents the portion of the findings of an Antelope Valley study that deals with attempts to combat overdraft and evaluates their relative merits. The lessons learned here are applicable to most areas that depend on limited

† Giannini Foundation Paper No. 143 Based on J. Herbert Snyder, *Factors Affecting the Ground-Water Economy of the Antelope Valley, Los Angeles County, California*, unpublished doctoral dissertation, University of California, Berkeley, 1954. 415 pp. A condensation of this dissertation is available as: J. Herbert Snyder, *Ground Water in California, The Experience of Antelope Valley*, Giannini Foundation Ground Water Studies No. 2, Berkeley, California, February 1955, pp. 171. The author is grateful to Professor S. V. Ciriacy-Wantrup, University of California, Arnold Brekke, formerly University of California, and M. L. Upchurch, USDA, for their helpful criticism of earlier versions of this paper.

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[1] Overdraft is the volume of ground water removed in excess of recharge within a particular area and for a specified time period. Average annual recharge—the flow resource—for this area is estimated to be about 40,000 acre-feet per year. Net draft is highly variable, but has exceeded 50,000 acre-feet per year since 1933. Cumulative overdraft as of 1952 is estimated to be 1,360,000 acre-feet. It is estimated that at the time of initial agricultural development in the Valley the ground-water stock resource, to a 500-foot depth (representing the approximate economic limits of pumping), was about 10,000 acre-feet. Snyder, *Ground Water in California, op. cit.*, pp. 81-98. Differentiation of overdraft as an analytical device in ground-water studies is considered in a forthcoming publication.

[2] P. M. Bartz, *Ground Water in California, The Present State of Our Knowledge*. Giannini Foundation Ground Water Studies No. 1. Second Edition, Berkeley, California, February, 1950. (Foreword by S. V. Ciriacy-Wantrup.) p. i.

ground-water resources for stability of agricultural production.

The degree of applicability depends upon the degree of similarity of physical and economic conditions in other areas as compared with Antelope Valley. Every research into water resource use problems uncovers certain unique characteristics which need separate evaluation. As a consequence, the degree of extrapolation of experience in one area to another must be left to the discretion of the individual student of water resource problems who uses the material provided by previous research.

Basic data necessary to evaluating overdraft in Antelope Valley have been accumulated through investigational programs and activities of the Agricultural Extension Service of the University of California, the Soil Conservation Service, the California Division of Water Resources, and others.[3] However, no significant reduction of overdraft has yet resulted. Such investigational activity and basic data gathering are a necessary part of any attack on over-draft, although any consequent net gain is difficult to assess. Awareness has heightened a local desire to combat overdraft. Shifts from alfalfa to field corn (from high water consumption to low water consumption per acre) have permitted water saving for individual farms. Most farmers tend to watch their level of irrigation more closely, thus saving water. But the rapid rate of agricultural development in the Valley over the latest decade has more than offset any gains resulting from the changed policies of individual farmers. Long-run overdraft has continued—and at an accelerated rate. More comprehensive measures were therefore attempted for controlling declines in ground-water levels.

[3] The activities of these organizations are treated more completely in a forthcoming publication.

Zoning, Water Law, and Overdraft

No unique device exists for the regulation of ground-water use because of the great variability in physical and economic conditions to be found in the West. Instead, a pyramiding of statutes and court decisions—varying from state to state—has led to numerous devices, each appropriate for a specific situation. Attempts to control ground-water use by zoning are relatively recent outgrowths of the inability of ground-water law to prevent overdraft and related problems. The nature of ground-water regulatory devices vary from place to place and are, therefore, best studied in local or regional settings.

Zoning ordinances utilize the police powers of the community to protect and promote certain types of land use by restricting others. Zoning regulations, generally, do not call for the performance of specific acts; they merely restrict individual initiative in land use and improvement to predetermined channels.[4]

Water law, having evolved with changing needs in development, use, and conservation of the resource, is characterized by duplications, omissions, and conflicts.[5] The California Water Code does not regulate ground-water use except from artesian wells (sections 300-311); in some southern California areas serviced by water from the Colorado River (sections 1005.1-1005.2); and from subterranean streams flowing through known and definite channels (section 1200).[6] The

[4] E. D. Solberg, "Rural Zoning in the United States," Washington, D. C., U. S. Bureau of Agricultural Economics, *Agricultural Information Bulletin No. 59*, 1952. p. 4. For a discussion of zoning as a tool of conservation policy, see, S. V. Ciriacy-Wantrup, *Resource Conservation, Economics and Policies*, Berkeley: University of California Press, 1952. pp. 282-286.

[5] For a comprehensive discussion of water law, see, Wells A. Hutchins, *Selected Problems in the Law of Water Rights in the West*, Washington, D. C., U. S. Dept. of Agric. Misc. Pub. No. 418, 1942, 513 pp., and The President's Water Resources Policy Commission. *Water Resources Law*, Vol. 3, 1950, 777 pp.

[6] State of California. *Water Code, 1951*, Printing Division. Documents Section, Sacramento, California, 1951. 756 pp,

evolution of ground-water law in California and most of the West has been shaped by court decisions and precedent, with little interference from state legislatures. The great variation in physical and economic resource conditions existing in the arid and semi-arid West has favored such an evolution with, for the most part, a like variation from place to place in permitted local attempts at overdraft control by zoning.

Experiment in Antelope Valley. Zoning activities aimed at ground-water overdraft have been short lived in Antelope Valley. In 1944 property owners, particularly those active in the soil conservation districts, became alarmed by receding water levels and requested the Los Angeles County Board of Supervisors to take action. Los Angeles County Ordinance 4457 N.S., adopted by the Board of Supervisors on February 20, 1945 and effective thirty days later, zoned the area against further ground-water development except by special permit.[7] The intent was to prevent well drilling for other than very essential needs and to prevent any property owner from drilling more wells than needed for maintaining and developing already established crops, thereby preserving the status quo until a master plan of land use or master conservation plan was prepared and adopted. The Los Angeles Regional Planning Commission was studying Antelope Valley soil conditions with this end in view, but the studies were dropped and "have not been resumed due to pressure of more urgent work."[8]

Before adopting the ordinance the County Counsel had warned the Board of Supervisors that such an ordinance would probably not be legal,[9] and indeed its constitutionality was attacked after several months by Superior Court Case No. 506889, entitled *Los Angeles County Farm Lands Company, a Corporation*, Plaintiff vs. *County of Los Angeles.*[10] In view of these facts, the Board of Supervisors repealed the ordinance by Ordinance No. 4659 N.S. on April 16, 1946, and the suit was withdrawn. During the year the ban was in effect "many applications were made to the Regional Planning Commission for [well drilling] permits most of which were granted and a few denied on the grounds that the proposed use did not justify the drilling of an additional well."[11]

The zoning ordinance had little effect in lessening overdraft in Antelope Valley. No reduction in anticipated draft was observed for the year 1945.[12] Any effect the ordinance might have had in subsequent years (had it remained in effect) would have depended upon the policy of the Regional Planning Commission in granting permits to drill new wells.

[7] Copies of the ordinances and the letters from the Los Angeles Regional Planning Commission and County Counsel cited below were obtained in 1950-51 by Mr. Victor W. Bruce for graduate seminar reports based on the early findings of this project and entitled, "Social Institutions Affecting Ground-Water Use in the Antelope Valley."

[8] Personal communication from Mr. A. H. Adams, Director of Planning, the Los Angeles Regional Planning Commission, to Mr. Bruce, 1950.

[9] The legal citation summarizing contemporary legal opinion on this matter stated, ". . . . if conservation be the end sought, it is not promoted by selecting a particular class of persons on an arbitrary basis and conferring special privileges on them and denying the same privileges to all others. . . ." *State exrel. Bacich* vs. *Huse*, 187 Wash. 75, 59 Pac. (2d) 1101, at 1105.

[10] Over 100 plaintiffs, owners of farm land in Antelope Valley, participated in this suit. The Los Angeles County Farm Lands Company, which held a "considerable amount of property," was nominal plaintiff. "All of the plaintiffs were farmers in the valley or were workers whose livelihood was directly affected by the proposed ordinance." Personal communication from Mr. Loyd Wright, attorney for the plaintiff, May 16, 1952. The Los Angeles County Farm Lands Company was organized in 1913, at which time 25,000 acres of land near Lancaster and Palmdale were purchased for "speculative purposes." No improvements were ever made and none of the land was ever rented. Land has been sold in large (farm sized) and small (lot sized) parcels, until only 160 acres now remain. When this last holding is sold the company will, for all practical purposes, cease to exist. Personal communication from Mr. P. E. Neuschaefer, Los Angeles County Farm Lands Company, July, 1953.

[11] Adams, *op. cit.*

[12] Snyder, *op. cit.*, p. 137 and Figure 4.1.

Even on a pro tem basis the attempt was not successful. Existing legal framework governing ground-water use will not permit enforcement of an ordinance that is discriminatory between those who have already begun to farm and those who wish to begin in the future. It will not permit restriction of water use to one person while at the same time permitting this use to another.

Unless some change is made in this framework, it will remain impossible to halt developments in an area while methodical investigations of and proposed solutions for existing problems are determined. Comprehensive land and water surveys would be necessary before an area is developed if the speed and degree of development (by zoning) are to be so regulated that overdraft may be prevented or at least minimized.[13]

Zoning activity in Antelope Valley since repeal of the ban has largely focused on land use, without direct reference to overdraft. As yet, the Master Plan of Land Use in Antelope Valley applies only to a narrow strip across the Valley that includes the urban areas and very little of the area devoted to irrigated crop production. Zoning attempts that focus on the water problems of irrigated agriculture have moved into the background.

Overdraft Elimination Not Probable. Future zoning against overdraft would necessarily be based on the amount of water available for apportionment on a per-acre basis.

A possible method of zoning control could divide water equally among cultivated acres. If zoning in Antelope Valley were based on average annual recharge volume of water (40,000 acre-feet), each acre would receive less than one inch of water per year upon ultimate development of the irrigable land (some 600,000 acres). No intensive agricultural crop enterprise could be supported by this small amount of water, which makes zoning for ultimate development unrealistic and unlikely, though such a goal was once hoped for.[14] Long-run overdraft in Antelope Valley could be eliminated by such zoning, but the consequences to agriculture appear to preclude its adoption. The amount of ground-water recharge available each year—the ground-water flow resource—is insufficient to support a valley full of intensive irrigated agricultural enterprises. An additional barrier would be the supervision and metering needed to regulate the ground-water draft of individual farms.

Another method of zoning control could reduce irrigated acreage to the maximum supportable by the annual recharge volume of water. Supportable acreage would of course depend upon the water requirements of the crops grown. Since zoning could not legally dictate the crops to be grown, a first approximation of supportable acreage should be based on a high water-consuming crop, such as alfalfa. When applied against an allowance of 5 acre-feet per acre per year for alfalfa requirements, average annual recharge in the Valley would support 8,000 acres—a total acreage less than one-fourth the present acreage in alfalfa alone. Nearly 600,000 acres of irrigable land would have to be zoned against agricultural use or belong to the community through governmental (state, county, etc.), or quasi-governmental (district) ownership. The volume of annual pumpage involved in the water rights of this large holding could then be sold to the farmers operating the 8,000 acres. Cultivation of crops that consume small volumes of water might

[13] Each area investigated, however, could present different situations, depending upon the quantitative relationships existing between the flow and stock components of the ground-water resource and the irrigable acreage.

[14] Adams, *op. cit.*

be brought about indirectly by expanding the amount of land privately owned and proportionately cutting the per-acre water allowance.

Public ownership of most of Antelope Valley is probably not politically feasible. Since very little irrigable land in the Valley today is publicly owned, nearly 600,000 acres would have to be purchased, involving enormous expenditures.[15] Such ownership would be necessary to acquire the overlying water rights, for effective control of pumpage. Such acquisition would be legally feasible but economically infeasible. Government proprietorship is frequently an important tool in controlling resource use, but basic resource imbalance between water and land apparently precludes its adoption in the Valley.

It is concluded that zoning to eliminate long-run overdraft is not probable in the Antelope Valley.

Conservation Perhaps Feasible. Conservation is defined as ". . . . changes in the intertemporal distribution of use. In conservation, the redistribution of use is in the direction of the future; in depletion, in the direction of the present."[16] Before considering measures directed at resource conservation, the need for conservation should be determined by appraisal of the resource in question. With abundant resources a thrifty husbandry may be inappropriate, especially when weighed against possible social and private costs. Conservation in terms of shifting use-rates into the future may also be inappropriate if technological advancement holds a key to open up new or substitute resources—such as importing water from surplus to deficit areas, substituting atomic power for conventional fuels, etc. However, foreseeing future advances of this nature is largely impossible, which prevents a true determination of the optimum resource use-rate over time. This "optimum state of conservation" may be specified theoretically in terms of maximum discounted net revenue over time, but practical limitations call for successive step-by-step approximations and appraisals over time as conditions change.[17]

Present physical, legal, and economic conditions of Antelope Valley, combined with major difficulties associated with water importation plans (discussed below), call for a conservation attitude toward the Valley ground-water resources.

The ground-water resources of an area may be differentiated into flow (average annual recharge) and stock or ground-water reservoir components. Relatively little can be done to affect the magnitude of flow resource, which is fundamentally determined by climate. Conservation measures must be largely directed at the stock component of the ground-water resources.

Any measure to shift ground-water stock resource use rates toward the future would be a conservation measure. Changing to crops that use smaller volumes of water or otherwise reducing the volume of irrigation applied each year could serve this purpose. Agriculture in Antelope Valley has so developed that none of these measures would of themselves have eliminated long-run overdraft. They would have been conservation measures, however, for long-run overdraft would have been shifted toward the future as a consequence of shifting the intertemporal distribution of use into the future.

Under the existing legal framework, conserving the ground-water stock resource is feasible through zoning that speci-

[15] Private land is currently selling for $500 to $1,500 per acre, depending on location, and conditions and purpose of the sale.

[16] S. V. Ciriacy-Wantrup, *Resource Conservation, Economics and Policies* Berkeley: University of California Press, 1952. pp. 51-53.

[17] Ciriacy-Wantrup, *op. cit.*, pp. 76-93.

fies the amount of water to be used per unit area of land. The type of crop to be grown could not be regulated directly. Restriction by the community of the water each owner may take is probably justified as "an adjustment of conflicting private rights and the apportionment of a common property right among the several owners."[18] In upholding the constitutionality of an Orange County, California, ordinance prohibiting waste and regulating the use of water from pumping wells, the court said:

"Legislation with respect to water affects the public welfare and the right to legislate in regard to its use and conservation is referable to the police power of the state . . . . [The ordinance] has for its purpose the conservation of subterranean waters, a legitimate field for the exercise of police power. . . . it seeks to prevent the undue waste of the percolating waters within the County of Orange, thereby conserving said water and materially benefiting the public welfare . . . ." [19]

Assuming that intensive irrigated agriculture will continue in the Valley, zoning to specify maximum pumpage volume on a per-acre basis would give each acre an equal share in the groundwater stock. The volume specified could be set to control—indirectly—the crops grown (i.e., high water users or low water users). Zoning to reduce annual draft rates, thereby shifting resource use into the future, would be a conserving action. Such zoning would have major enforcement problems. Maintaining specified pumpage volumes would require metering of draft volume for each irrigation pump, which would be expensive.

A possible alternative, keeping records of crop acreages for each property unit, could approximate the same result. For example, water allotments set at 2.5 acre-feet per acre per year for a farmer operating 160 acres would permit 50 acres in alfalfa (high water requirements) and 110 acres fallow. The farmer would then be assumed to be within his permissible volume of pumpage.[20] If the entire acreage were devoted to irrigated cereals or vegetable crops (low water requirements), it could be assumed that the farmer was not pumping more than his allotted volume. This would not be as accurate as metering pump draft, but could be operated at lower cost to the enforcement agency and would presumably not be greatly in error. Although overdraft would continue, conservation would be effected.

Furthermore, the unnecessary practice of overirrigation—which frequently leads to wasting water—would be controlled. Thus zoning to conserve the groundwater stock resource might also lead to improved farm management practices. Zoning to conserve ground water in the Valley probably could not be instituted without opposition, but it appears to be legally and technically feasible.

"*Pay as You Pump*"

Similar in some respects to the Antelope Valley overdraft problem is the overdraft experience in Orange County, California, also centering around a localized overdraft situation.[21] The pro-

[18] *People* vs. *New York Carbonic Acid Co.*, 196 N. Y. 421, 90 N. E. 441, at 448.

[19] *In re Maas*, 219 Cal. 422, 27 Pac. (2d) 373, at 424 and 425.

[20] In this situation the farmer could be applying as much as 7.5 acre-feet to each acre in alfalfa and still not exceed his allotment. If he were to apply only 5 acre-feet per acre to alfalfa, he could devote one-half of his acreage to this crop and fallow the remainder. Such situations, however, would not necessarily constitute economic units of operation.

[21] Information on Orange County ground-water problems is from the following reports: C. R. Browning, "Contributions of the Flow of Santa Ana River to Coastal Basin Replenishment or Beneficial Use in Acre-Feet," Tustin, California, August 1952, 7 pp. Processed. (Report by C. R. Browning, Consulting Civil Engineer.); W. D. Miller, "To the Citizens Water Conservation Committee," Santa Ana, California, August 1952, 8 pp. Processed. (Report by W. D. Miller, Secretary of the Orange County Water District.); and Ross A. Shafer, "Statement to Joint Legislative Interim Committee on Water Problems, Re: The Proposed Plan for the Replenishment of the Coastal Basin of Orange County, California," Orange County Water District, Santa Ana, October, 1952. 8 pp. Processed.

hibition of waste and regulation of use of ground water by law was not enough to prevent overdraft because of basic water-land resource imbalance. In 1951 estimated net draft amounted to 203,000 acre-feet per year and average recharge 136,000 acre-feet per year, leaving an average annual deficit, or overdraft, of 67,000 acre-feet. Salt water from the ocean has infiltrated the ground water until nearly 5,000 acres of land along the coast are now underlain by ocean water. It is estimated that restoring water (and pressure) to 1920 levels would halt further salt water encroachment. To do this, a total recharge volume of about 375,000 acre-feet must be restored to ground-water storage. Annual recharge importations must overcome accumulated deficit as well as average annual overdraft.

Two major problems are involved: where to get the necessary volumes of water, and how to pay for it. The first problem is answered by obtaining water from the Los Angeles Metropolitan Water District which controls Colorado River water delivered to the Los Angeles and San Diego areas. The second problem has defied answer for many years. Recent passage of Senate Bill 91, however, an amendment to the Orange County Water District Act, may not only solve the overdraft problem of Orange County but also set a pattern for solving some types of localized overdraft problems in other areas.[22]

The act sets forth as its major purpose the replenishment of underground water supplies of the Orange County Water District. Two methods of payment will provide the water necessary to fulfill this objective. The district may levy a general tax, not to exceed eight cents per $100 of assessed valuation of real property, including improvements. The tax would range from less than 25 cents per acre of ordinary cropland to about $1.00 for the best orange groves. Water purchases from this tax fund (used to overcome cumulative overdraft only) are limited, to protect non-farm property owners from subsidizing payments for water necessary to eliminate annual overdraft induced by farmers.

The second method of payment is a pumping assessment (extraction tax) not to exceed $5.50 per acre-foot for ground water pumped within the district. For the typical farmer, assumed to be pumping ground water at an average cost of $4.50 per acre-foot, total cost of pumping plus the levy would be $10.00 per acre-foot—or less if the pumping assessment is less than the maximum. The total cost paid by the farmer will vary with crop, price levels, irrigation practices, soil type, climatic variations, etc., but for most crops and "average" situations a cost between $8.50 to $10.00 per acre-foot is probable. Every well in the district has been registered and water meters are being installed. It is hoped that the plan will be in full operation by 1955, when the first extraction tax will be available.[23]

It is believed that annual income in the Orange County Water District will be enough to control annual overdraft and eventually correct accumulated overdraft. One of the major advantages of this plan is that it does not, insofar as can be determined, interfere with water rights of the individual property owner any more than does any ordinary property tax. Furthermore, it dictates payment in proportion to the amount of ground water used by each pumper. To the same extent that a particular individual contributes to local overdraft he must pay to help overcome the overdraft.

[22] California, Statutes of 1953, Chapter 770. Deering's California General Laws, No. 5683.

[23] Personal communication Mr. W. D. Miller, Secretary, Orange County Water District, July 13, 1953.

Could the Orange County Plan Work in Antelope Valley? Many points of similarity exist between the Orange County ground-water economy and that of Antelope Valley. The major points of difference revolve around magnitude of overdraft and source of imported water. Current annual overdraft in Orange County is approximately one-half the current annual overdraft in Antelope Valley. To restore ground water to 1920 levels would require 375,000 acre-feet in Orange County, and nearly 2,000,000 acre-feet in Antelope Valley. At the same time the average Antelope Valley farmer with field crop farms cannot afford as high tax rates as can the average Orange County farmer who specializes in citrus.

The first problem to be solved would be organization of a district with power to levy both the ad valorem land tax and the use-charge pumping assessment. Such a district could be formed in the Valley pursuant to California law. But are the other problems soluble? What are the possible sources of water to be used to recharge the Antelope Valley ground-water stock resource? The Owens Valley-Los Angeles Aqueduct, crossing the western end of the Valley, transports slightly more than 300,000 acre-feet per year through the area. Water could be spilled into dry stream beds for natural recharge, or delivered by gravity to most areas of Antelope Valley for direct irrigation if conduits were constructed. But legal, physical, and economic bars prevent such supplying of water to the Valley by the Los Angeles Department of Water and Power.[24]

Los Angeles water rights in Inyo and Mono counties (to supply the aqueduct) are appropriative and limited to the use of the city and its inhabitants unless surplus water exists. No surplus water is available in the aqueduct. Exchange or sale of aqueduct water for use in the Valley would therefore require the assent of two-thirds of the qualified voters of the city of Los Angeles. Furthermore, the costs associated with purchase and distribution of water to replace aqueduct water plus loss of revenue from power generation by aqueduct water below Antelope Valley raise impossible economic barriers, even if legal and physical obstacles could be overcome. Supplying water to Antelope Valley from the Los Angeles Aqueduct is not feasible under present conditions.

Direct supply of water to the Valley from the Metropolitan Aqueduct (Colorado River water) is not technically feasible because of differences in elevation, Antelope Valley being much higher than the Metropolitan outlets. The cost of lifting water into the Valley, plus prior water rights by other areas of metropolitan Los Angeles, tends to bar this water as a possible source of water for Antelope Valley.

Feather River water is priced too high ($50.00 per acre-foot) for Valley farmers.[25] Unless the cost to farmers is at least partially subsidized, Feather River water is not a probable water source for Antelope Valley agriculture.

If a firm water supply could be provided at prices Valley farmers could afford, a plan similar to the Orange County Water District Plan could stem long-run overdraft in the Valley. Unless such a supply can be provided, the only alternative is to conserve the limited stock resource as efficiently as possible.

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[24] Personal communication Mr. S. B. Morris, General Manager, Department of Water and Power, the City of Los Angeles, December 30, 1953.

[25] Snyder, *op. cit.*, pp. 115-128 and 147-148.
State Water Resources Board, *Report on Feasibility of Feather River Project.* Sacramento, California: Department of Public Works, Division of Water Resources, State Printing Office, May 1951, 127 pp. Mimeo.

State-Wide Activity

The Division of Water Resources of the California Department of Public Works has engaged in irrigation, drainage, and water development investigations and programs. Part of this activity has involved cooperative investigations with other state, local, and federal agencies. Division activities in Antelope Valley have been restricted, essentially, to gathering basic data, with little or no direct impact on the local overdraft problem. The State Water Resources Board has been created as an administrative board using the Division of Water Resources as the investigating agency to make state-wide investigations of water resources, their use, and their development. The proposed Feather River Project—to take water from the Sacramento Valley and move it over 500 miles into southern California—is one of several outgrowths of their investigations.

The State Water Resources Board was created to investigate California's water resources. In 1947 the Board was authorized to make, and funds were appropriated for, a thorough state-wide water investigation.[26] The investigation work is conducted by the Division of Water Resources, under the direction of the Board. This investigation has included Antelope Valley only incidentally as one of several areas in the state faced with the problem of water supply inadequate for the amount of permissible ultimate development. The proposed Feather River Project may alleviate the water shortage in southern California in general, and Antelope Valley in particular.

In August 1951, applications were filed on behalf of the State Department of Finance to appropriate water from Feather River, Italian Slough, and Old River for use in "areas south of Tehachapi Mountains" (i.e., southern California) and other areas south of the Sacramento-San Joaquin Delta area.[27] No specific amount of water has been allocated to Antelope Valley nor to other areas in the category covered by "areas south of Tehachapi Mountains." The Feather River Project is not as yet authorized for construction; only preliminary investigations have been launched.

The initially-listed sale price for Feather River Project water of $50.00 per acre-foot in areas south of the Tehachapi Mountains is more than agricultural users in Antelope Valley can pay.[28] Thus far, water importations into Southern California have been stimulated primarily by nonagricultural pressures. Large demands of the urban population (residential, commercial, and industrial) have exhausted local water supplies. Urban users can afford to pay the cost of water importations. In the city of Los Angeles during the period 1946-1949 payments by residential water users averaged $66.38 per acre-foot and commercial water users made payments averaging $53.64 per acre-foot, while the few sales for agricultural irrigation averaged only $6.78 per acre-foot. The rates of payment for nonagricultural use are close to the suggested sale price of $50.00 per acre-foot for Feather River water in areas south of the Tehachapi Mountains. The question to be answered in such situations concerns the level of subsidy to agricultural water users, if any, that nonagricultural water users should support. Technology, ability to pay, need for water, and other institutional factors favor a solution to water shortage problems through transfer of water from

[26] State Water Resources Board. "Water Resources of California." Sacramento, California: Bulletin No. 1, 1951.

[27] Personal communication from Mr. A. E. Edmonston, State Engineer, 1952.

[28] Depending upon the crop grown, a maximum of $7.00 to $17.00 per acre-foot has been suggested for 1946-1951 crop price levels. Snyder, *op. cit.*, pp. 115-128 and 147-148.

surplus to deficit areas. But though this solution may prove economically, physically, and legally possible, there is still the serious drawback that it may offer only temporary respite to agriculture until urban demands again claim the limited water resource.[29]

Notwithstanding the obstacles, it is apparent that the only method of materially reducing long-run overdraft in Antelope Valley involves importation of outside water. Zoning, without additional imported water, cannot eliminate overdraft in Antelope Valley but could act to conserve the stock resource. Reduction of acreage to eliminate or reduce long-run overdraft will not occur unless marginal producers are forced out as economic limits of pumping are reached, thereby bringing about a balance between average annual draft and recharge. Political pressures, brought to bear if the latter situation were to develop, would probably prevent such extreme results.

Combating Overdraft

Investigations and action programs launched in Antelope Valley have led to only small gain in the battle against overdraft. Many of the recommended actions have led to the accumulation of data and information on water use that are valuable in the analysis of overdraft, but agricultural development of the area has proceeded at such a rapid rate that individual on-the-farm gains have been more than offset by water use in new development.

Specific actions and measures effective in eliminating long-run overdraft are seriously affected by two sets of conditions. First, the physical resources available and their potential balance or imbalance can easily, as in Antelope Valley, make control of overdraft extremely difficult. Second, economic factors that dictate resource utilization may be so strong as to offset actions designed to combat overdraft. Zoning attempts have been either legally unsound or so difficult of enforcement that they have had to be abandoned.

If the ground-water flow resource of a given area is, or can be modified to be, sufficient to support an economically desirable agricultural economy in that area, then the existing legal framework governing resource utilization can be effective in controlling overdraft. If, as in Antelope Valley, the local economy is already developed far beyond the capacity of the flow component of the ground-water resource, with consequent mining of the stock resource, no simple solution is in sight. If a firm supply of imported water could be provided at a price Valley agriculture could pay, some form of a "pay-as-you-pump" plan, similar to the Orange County Water District plan, might reduce and eventually eliminate long-run overdraft in Antelope Valley.

Zoning to conserve the stock resource is recommended if the Valley desires to reduce overdraft. Enforcement of zoning measures necessary to eliminate overdraft in the Valley is not feasible without a firm supply of inexpensive imported water. Without supplemental imported water at a price Valley farmers can afford, the best that can be done—legally, economically, or politically—is to conserve the ground-water stock. Long-run overdraft will continue.

Economic forces will bring about a more or less gradual shift out of agriculture as the economic limits of pumping are approached. Urbanization may not only soften the harshness of such a transfer, but also act to subsidize, in part at least, the importation of water to the

[29] "It is hereby declared to be the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation." Section 106. *Water Code, 1951*, State of California, *op. cit.*

area. Importation from surplus to deficit areas—favored by technologic, economic, and political factors—would increase the ground-water flow resource by direct addition of imported water to the stock or its diversion to irrigation.

Further experience and research with a water import plan is necessary to determine the temporary or permanent nature of such a solution and the levels that would result in a balance between ground-water flow resource (recharge plus imported water) and draft. Barring imported water, long-run overdraft in Antelope Valley and similarly characterized areas will continue until economic forces bring a balance between recharge and draft.

Some Fundamentals of Mineral Economics

By ORRIS C. HERFINDAHL*

IT is the purpose of this paper to provide a simple account of some processes involved in the economics of exhausting assets, especially an account of exploration. The resulting analytic framework should be helpful in evaluating recent suggestions on materials policy and also in thinking about currently pressing problems flowing from widely advertised "shortages" of certain minerals.

Some of the elements involved in the exploration process have been discussed in two of the leading articles in this field, but they leave the role played by exploration essentially untouched. The elementary economics of the mining firm was given a very satisfactory exposition in 1913 by L. C. Gray.[1] Eighteen years later, Hotelling analyzed competitive and various non-competitive situations in exhausting assets, but his work involved the assumption that it is known that all deposits of the mineral have been found.[2] A description of the exploration process requires examination of the mineral industry as well as the firm and introduction of the assumption that more mineral deposits can be found at some cost. We shall proceed by discussing first the competitive minerals firm, following Gray, and then the competitive minerals industry. The analysis will be applied to a problem in mineral taxation and to some exploration data for petroleum.

The Competitive Mine

The competitive mine operator is faced with the problem of determining how rapidly to extract mineral from the ground. In the discussion of this problem it is assumed that (1) the anticipated price of ore is constant, (2) the ore is of uniform quality, (3) the contents of the mine are known to the operator, and (4) marginal cost in any given year and the corresponding average variable cost are a function only of the rate of output in that year. The investment in mining equipment is assumed to have been made, and marginal cost, as here used, contains no element of revenue foregone by producing a unit of output in one period rather than another. The resulting quasi-rent goes to cover the cost of reproducible mining equipment and the investment in the mineral deposit. For other purposes more elaborate assumptions might be desirable; for example, making marginal cost in any period dependent in some way on the set of outputs over the life of the mine or on the cumulated output from the mine. The simple assumptions used here will serve well enough, however, to illustrate the problem confronting the mine operator.

To choose the mine's output schedule, each period's marginal net return (price minus marginal cost), in dollars of present value, must be compared with the marginal net returns of the other periods. It is immediately evident that it is necessary that the marginal net return must be the same in every year of the mine's life, for otherwise profits could be increased by shifting output from one year to another. Comparison of the present values of marginal net returns will be facilitated by the diagrams in figure one showing demand and cost curves for successive years of the mine's operation.

In figure one, price is assumed to remain at six dollars and all dollar values

* Committee for Economic Development, Washington, D. C. Responsibility for the views expressed rests with the author and not the CED.

[1] L. C. Gray, "Rent Under the Assumption of Exhaustibility," *Quarterly Journal of Economics*, Vol. 28, 1913-14, pp. 466-89.

[2] H. Hotelling, "The Economics of Exhaustible Resources," *Journal of Political Economy*, April, 1931, pp. 137-75.

are measured from this level. Hence the zero on the vertical scale corresponds to a level of six dollars. There is no discount factor applied to year one, but in year two the line from which cost is measured (in present value) is moved up so that the distance to the line indicating price is equal to $\$6/(1+r)$, where r is the rate of discount. In the diagram a discount rate of thirty percent has been used to make its effect easily visible. Costs in year three are similarly discounted and are measured from the third abscissa. Thus the cost curves flatten out and move up for more distant years, but any portion of a cost curve

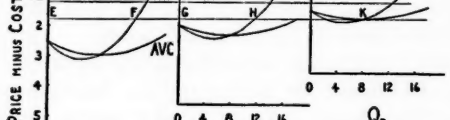

FIGURE 1 (Price minus cost measured in present value.)

below the price line in year one will also be below it in any later year. This representation is equivalent to plotting the present value of price minus cost for successive years, as is indicated by the label for the vertical axis. For every year, equal vertical distances represent the same number of present dollars.

To illustrate the equating of marginal net returns in the years of the mine's operation, suppose, first, that the length of the period over which the mine is to be operated is dictated by a wise government (hypothetical) and is set at two years, with the further requirement that the mine be operated at a uniform rate of output throughout any single year. With the present value of the difference between price and marginal cost the same in each year, that level of (P—MC) is selected which will enable the contents of the mine to be extracted within the dictated period.[3] If the contents of the mine are twenty-nine units, the operator selects outputs of approximately fifteen units (AB) for the first year and fourteen units (CD) for the second year. Any shift of outputs will reduce profits, as is evident on inspection of the diagram.

If the directive is changed to permit any length of life for the mine, the operator must decide whether it is profitable to extend the life of the mine by transferring output from earlier to later years. In the example, he will transfer output from years one and two to year three in such a way as to leave the present values of marginal net revenue equal for the first two years. The net revenue loss on units transferred from the earlier years is approximately equal to the change in output times marginal net revenue. The net revenue gain from the additional output of the third year is equal to output transferred times price minus minimum average variable cost. In the example this minimum is attained at an annual output rate of eight. He may, of course, operate at this rate for only a part of the third year.

So long as maximum average net revenue in year three is greater than marginal net revenue in the first two years, it will pay him to transfer more output to the third year. In the present example the finish of this adjustment process is indicated by line EK. The present value of the marginal net revenue in each year is equal to the maximum average net revenue in the last year of

[3] If the contents of the mine are large enough, this condition may involve operation at outputs with marginal cost greater than price. If the mine operator is required to exhaust the contents in two years, he will operate at these outputs, with the second year output greater than the first but, if the government permits him to abandon part of the mine's contents, he will produce equal outputs in the two years with marginal cost equal to price.

operation, with outputs in the three years of approximately 13.5 units (EF), 11.7 units (GH), and 3.9 units. The output of 3.9 units in the third year is produced in a little less than half a year at an annual rate of eight units. It would not pay to transfer any output to the fourth year unless the contents of the mine were somewhat greater than 33.2 units (=13.5 + 11.7 + 8), that is, unless the present value of marginal net revenue, adjusted to a three-year plan of operation, is less than the present value of maximum average net revenue in the fourth year.

The Long Run: Constant Cost of Exploration

The preceding section has not involved the problem of adjustment in the number of mines. The possibility of finding new properties by exploration makes the analysis of this problem for the exhausting resource quite similar to that of industries using only reproducible assets. It is only at a late stage in the history of an exhausting resource that the problem takes on peculiarities that distinguish it from the case of reproducible assets.

The first long run case to be considered is the simple one in which the quality of ore discovered remains constant, on the average, and the average cost of discovering a ton of metal (or ore) remains constant. It is immediately evident that the long run equilibrium, after proper imputation of returns, will be characterized by zero profits for the industry in both exploration and mining. The "profits," or rent, on the deposits discovered will be entirely consumed by the cost exploration. If true profits do appear for the industry as the result of an increase in, say, demand, exploration activity will increase, resulting in a larger stock of known properties. Since no property will be held idle if the industry is competitive (unless costs are too high for properly defined variable costs to be covered), current output will increase, the price of metal and ore will decrease to the original level, and exploration activity will then decrease, but not to its original level.

From this simple schema it is evident that the stock of known properties is not a matter of happenstance but is determinate and governed by economic forces. Proximately, the stock of properties in long-run equilibrium is related to the output of the industry and the rates at which properties are exploited. The governor that brings about changes in the stock of properties is profits after allowing for exploration costs.

The principal variables lying behind the industry's rate of output and the rate of property exploitation are the following:

1. *Demand.* If demand increases, price goes up, producing profits and an increase in exploration activity. The stock of properties is increased, current output increases, and the price of ore declines to its original level. The stock remains greater, industry output is higher, as is also the volume of exploration activity in order to maintain the larger stock of properties.

2. *Cost of exploration.* If the cost of exploration declines, profits appear in exploration. Exploration activity increases the stock of properties, and the prices of metal and ore decline in response to a greater output of ore and metal until, on the average, profits from exploration are zero. The stock of properties is permanently larger as is also the rate of exploration.

3. *Economies of scale in mining.* The larger the output at which diseconomies of scale appear in mining, the more rapid will be the rate at which a particular property will be exploited, and the lower will be the supply price for ore.

4. *The rate of discount.* The higher is the rate of discount, the more rapid is the rate of exploitation, and the higher will be the supply price for ore.

5. *The average size of property.* If the typical mining operation incurs increasing costs after a certain output if it increases output per year, an increase in average size of deposit

will lead to an extension of mine life and an increase in the supply price of ore. With a larger size deposit the mine operator could keep the same mine life, but he can escape some of the diseconomies of scale by extending mine life and increasing his annual outputs by a smaller quantity than if life was left unchanged.

The above five factors are the principal ones affecting the industry's rate of output and the rate of property exploitation. This is not a complete catalogue, and an analysis of the factors considered here could easily be quite complex, but at the least it should be clear that the stock of known properties is a determinate result of demand and cost conditions in exploration and mining.

The Long Run: Rising Cost of Exploration

On the assumption that the cost of exploration rises with the cumulated discoveries of the industry, we now examine relations among cost of exploration, price of ore, rate of exploration, and the stock of properties, following the course of the mineral industry to the end of its life.

Changes in the number of mines are brought about by the presence of profits or losses in exploration, that is, by the difference between the value of a typical known property and the cost of discovery. The present price of ore and the cost of mining together with prices and costs anticipated over the life of a mine determine the present value of a typical deposit of ore in the ground, and the difference between this value and the cost of discovering a typical deposit determines the direction that will be taken by the volume of exploration activity, with the usual short- and long-run adjustments when the output of the exploration industry changes.

With a shift from constant to rising cost of exploration, the life of a mine will be lengthened and the stock of properties will decrease with further rises in price. The stock of properties will decrease because a negatively-sloped industry demand curve and a rising cost of exploration will result in losses if the stock is not diminished. At all times the quantity of ore coming on the market in any year will be equal to the quantity of ore discovered plus the decline in the stock of properties and, when the system is moving along in equilibrium, the value of known deposits will be rising, the discovery rate and the stock of properties will be declining with the quantity of ore placed on the market resulting in a price that fulfills price expectations in the sense that the value of ore in ground moves up with the cost of exploration. While the price of ore in ground moves up with the cost of exploration, the rate at which the cost of exploration rises depends on the cumulated discoveries of the industry which in turn depend on the rate at which price rises. This interrelationship may be clarified by considering what would happen if further discovery is impossible.[4]

If further discovery is impossible, the price of ore in ground will rise at a rate equal to the rate of discount. If it were anticipated that price would rise faster than this, properties would be withheld from current production to take advantage of the higher future prices and vice versa. With price rising each year by the rate of discount, the time at which a property is exploited would be a matter of indifference for any single operator. The date of complete exhaustion of all reserves will depend on the complete demand curve.

Suppose next that further discovery is possible, but only with rapidly rising exploration cost. Under these circumstances, the bulk of current supply will

[4] This is the case that was examined by Hotelling in 1931.

come from reduced stock, but exploration will take place as price moves up, preventing price from rising as rapidly as the rate of discount but with exploration still not in sufficient volume to maintain the stock of properties. Exploration will continue, at higher and higher cost, until price finally gets so high that nothing is purchased, and the "day of judgment" for this mineral will have been reached. The mineral will almost surely not be completely exhausted but, given demand, it simply will not pay to continue looking for it.

The above discussion has proceeded on the assumption that the economy in question is isolated. If this is not the case and the mineral can be imported, the situation is quite analogous to the domestic case where different producing regions are involved, a problem that has been avoided in this discussion by the implicit assumption of a uniform average cost of exploration throughout the country. With this restriction removed, the regulator of exploration activity in each region or country is still the gap between average price of ore in ground (price of metal less smelting and mining cost) and the cost of exploration. In equilibrium, cost of exploration, though not necessarily the same in each region because of transportation and other cost elements, will move up by the same amount in all regions as time progresses, although regional differences in the behavior of the exploration cost functions may produce shifts in the relative quantities supplied by the different regions. If a new producing region is discovered, there are two effects as its output increases: the price of metal is pushed down, though very little if the region is unimportant relative to total supply, and the cost of exploration in the new region rises until it is "equated" with the cost of exploration elsewhere, that is, until there is no gap between price of ore in ground and cost of exploration in the region. Finally, mention should be made of the influence of scrap recovery. The effect of the scrap component of supply is to reduce the demand for primary metal. The supply curve for metal from scrap will depend on the stock of metal in use, its age distribution—though this is not of much importance for the long run problem—the scrap rate, and collection and processing costs. In those cases where irretrievable losses in use are low, scrap can act as a powerful factor to cut down the rate at which reserves in the earth are exploited. This is obviously not true for fuels, but the recovery rate is significant for many metals.

The preceding discussion has covered only the competitive firm and industry. In addition to the non-competitive situations, there are many factors that have not been considered, two of which are mentioned here. First, technological development at the several levels of production can stave off long-run difficulties and, for considerable periods of time, actually overcome them. Second, the analysis has proceeded as if metals are independent in production. This is not true in many cases. Copper, lead, zinc, gold, and silver, for example, are often associated in various combinations in the same ore. Because of association of metals in ores and also because an explorer is often uncertain of what ore he will find, exploration activity is also likely to involve more than one metal and more than one type of ore. Some of the modifications necessitated by these factors are clear enough. Others would require much development. A simple account of the exploration process has been presented here, however, in the belief that it will be of some service in the consideration of minerals problems.

An Application of the Analysis

One of the important problems to which the preceding discussion of the exploration process can usefully be applied is capital recovery in the minerals industries for tax purposes. In the case of reproducible assets, the basis for capital recovery under federal income tax law is the cost of the asset. If the tax laws are to leave investment in minerals industries just as attractive as in other industries, neglecting the problem of risk aversion or preference, what should be the capital recovery provisions for minerals?

The statement is often made that since a miner is using up his capital with every ton of ore taken from the ground, he must be allowed to deduct the value of the ore mined (presumably value in ground) as an expense if he is to have adequate funds to acquire another deposit and continue operation. If this is permitted, however, investment in minerals will be favored over investment in other industries. If the minerals industries are in long-run equilibrium, it is true that capital recovery equal to value of mineral in ground would provide a sum equal to the cost of finding the properties. There are difficulties, however, resulting from the fact that some firms spend money on exploration without results. If they are permitted to deduct these expenditures, as they should be, and at the same time the successful firms are permitted deductions equal to the value of known mineral in ground, the total deductions allowed the industry will be greater than the expenditures incurred in finding the properties, contrary to the practice for other industries where deductions may not exceed the cost of acquiring the property. To put it simply, the lucky firms should not be permitted to make capital recovery deductions for capital invested by the unlucky firms, which is what they would be doing if they deducted the full value of the ore they mine rather than the cost incurred in finding it. If the firms are restricted to deduction of actual costs incurred, as they should be, deductions will not be sufficient to provide for replacement of each property when the cost of exploration is rising. This is, of course, a desirable result.

The writer hastens to add that market value of ore versus cost as the basis for capital recovery is not a live issue in the politics of mineral taxation. Actual deductions go far beyond either standard. The problem has a measure of current interest, however, because the assertion that market value is the correct basis for capital recovery is sometimes used, illogically, to support the percentage depletion system.[5]

Exploration for Petroleum

It may be objected that the hypothesis under consideration, that the volume of exploration activity depends on the anticipated profit from exploration, cannot adequately describe the operation of minerals industries because exploration is so uncertain an activity that it will not respond systematically to changes in profit. It is the purpose of this section to see whether exploration for petroleum responds to variables that may be taken to represent changes in average expected profit. Oil is selected for examination because some relevant data are available over a long period of time, especially a measure of exploration activity.

The mere existence of exploration activity that is unrelated to expected profit is not sufficient to invalidate the hypothesis that the volume of exploration depends on expected profit. Although some or even a large amount of exploration may take place in ignorance

[5] The time pattern of deductions for depletion can usefully be regarded as a separate issue from the problem of the total amount of deductions allowable over the life of the property.

of profit prospects or because of risk attraction, activity that is geared to profit may still dominate the behavior of the total volume of exploration.

The annual number of wells drilled in the United States is used as a measure of petroleum exploration activity.[6] The deflated price of crude oil[7] and deflated private final product[8] will be used as indicators of anticipated profit. The data cover the period from 1909 to 1949, with 1917-18 and 1942-45 omitted because the variables were not free to move in their usual fashion in these years. All variables are expressed in deviations from trend rather than in absolute values.[9]

Trends have been eliminated to prevent them from dominating short-term changes in the variables. The long-term changes in these and related variables are, of course, of great interest. The wells-drilled series has a substantial upward trend over the forty-year period, the trend value increasing from eighteen thousand in 1909 to thirty thousand in 1949, an increase of two-thirds. The deflated price of crude, with sizable fluctuations, has very little trend over this period, with a fifteen percent increase from $1.25 per barrel to $1.43 (deflated price). At the same time, the increase in crude production was enormous. The 1949 trend value of 1.90 billion barrels was eleven times the 0.17 billion barrels produced in 1909. The much smaller increase in wells drilled is the result of declines in two ratios, the ratio of reserves to annual production and the number of wells drilled per unit of discoveries and new developments. Both of these series declined during the first half of the period from 1909 to 1949 and were roughly constant in the last half. The ratio of reserves to annual production fell from about twenty-two to around thirteen. Thousands of wells drilled per billion barrels of discoveries and new developments fell from roughly forty to around eleven.[10] The changes in these two ratios are probably to be accounted for mainly by technological developments in search, drilling, and production.

With trends eliminated, the following correlation results are obtained:

X_1 Wells drilled (deviations from trend)

X_2 Deflated price of crude (deviations from trend)

X_3 Deflated private product (deviations from trend)

r_{12}	.70	r_{13}	.56	r_{23}	.06
$r_{12\cdot3}$	.81	$r_{13\cdot2}$	.73	$R_{1\cdot23}$	.87

Both the price of crude and private product contribute substantially to explaining the variation in wells drilled. The price of crude plays an obvious role as an indicator of anticipated profit, but the interpretation of private product is less clear. It might be viewed as an indicator of shift in the demand curve or may indicate a combination of availability of funds, the elusive element of confidence, and estimates of shifts in the demand curve.

A check on these results is possible for the period after World War I by using

[6] *Petroleum Facts and Figures, 1950* (New York: American Petroleum Institute) p. 121. This series embraces dry holes and all successful oil wells, including development wells and gas wells. Service wells are excluded. Some writers would probably wish to exclude development wells (those drilled within one mile of a producing well) leaving only the exploration wells. Although the probability of success is quite different, both types are open to the influence of changes in anticipated profit, and both types of drilling result in the verification of deposits whose presence was suspected but not known with certainty.

[7] *Ibid.*, p. 121. The price of crude was deflated by the B.L.S. wholesale price index.

[8] Deflated gross private product for 1929 to 1949 was extended back to 1909 by a deflated net private product series. The deflated gross private product series is from p. 146, *1951 National Income Supplement* to the *Survey of Current Business*. The deflated net private product series is taken from p. 544 of A. G. Hart's *Money, Debt, and Economic Activity*.

[9] A linear trend was eliminated from the wells drilled and price series. Deflated private product was expressed in deviations from a linear logarithmic trend.

[10] The data from which the two ratios have been calculated are from *Petroleum Facts and Figures, 1950*, pp. 121 and 182.

profits after taxes in the crude oil and natural gas industry as an indicator of anticipated profit from petroleum exploration.[11] The variables considered here for the years 1919-41 and 1946-49 are as follows:

X_1 Wells drilled (deviations from trend previously calculated)
X_3 Deflated private product (logarithmic deviations from trend previously calculated)
X_4 Deflated profits (deviations from linear trend)

The simple correlation between wells drilled and profits after taxes is moderately high (r_{14} = .74). The partial influence of private GNP with the influence of profits "eliminated" ($r_{13.4}$ = .45) is much lower than it was with the price of crude as the third variable ($r_{13.2}$ was .73). Consequently the multiple coefficient, $R_{1.34}$ = .80, is not much higher than the simple correlation between wells drilled and profits after tax (r_{14} = .74). Profits, a most reasonable indicator of anticipated profit, do appear to play an important role in explaining the variation in wells drilled.

These data as well as those for the longer period from 1909 to 1949 do not suggest that all exploration for petroleum is systematic but only that the systematic portion is large enough to dominate the behavior of total wells drilled.

The hypothesis that exploration responds to anticipated average profits has here been applied only to petroleum. Unfortunately, measures of exploration activity are not yet available for other minerals. If such measures become available, it is the writer's view that exploration for these minerals will be found to be systematically related to variables reflecting anticipated profit. The joint product aspect of mineral exploration and production will considerably complicate matters, of course.

The contrary hypothesis, that exploration in total is not systematically related to profits, is not attractive either for petroleum or other minerals. The important condition necessary to attract "rationally" managed funds to exploration is that the dispersion in the success attending the repeated investment of a given sum of money not be too high. There are two reasons for believing that this condition is widely met. If by exploration is meant an attempt to get additional information on the presence or absence of a mineral deposit, then much of it is not a matter of search in unknown areas with a low expectation and high dispersion of success for repeated efforts of limited size, but rests instead on relatively good prior knowledge and a fairly high expectation of success. This view seems reasonable because so much exploration activity apparently is based on contiguity and extension.

From the viewpoint of the investor, another source of stability in the success of investment is the availability of devices for spreading risk, such as the corporation. This factor is independent of the preceding one and can operate even though the expectation of success for exploration efforts of small size is very low and the dispersion of results is high. In this way the problematical success of limited exploration operations can be overcome, with the investor remaining exposed to much the same kinds of uncertainty that accompany investment in firms outside the minerals industries.

[11] The profits series is taken from *Statistics of Income* and is deflated by the B.L.S. wholesale price index. After 1937 the Bureau of Internal Revenue has separated field services from the oil and gas industry, but I have included field services over the whole period. For the present purpose this industry and some others should be excluded from the profits series, but the difficulties in doing so are very great. The series suffers from another defect in that the capital recovery deductions allowable for tax purposes are not closely related to deductions that are relevant to determining the profitability of crude oil production for the purpose of investment.

Is the "Theory of the Firm" Misused in Current Land Economics Research?

By C. CLYDE MITCHELL*

A NUMBER of research monographs, bulletins, and journal articles on production economics appearing in recent years have attempted to build upon the "theory of the firm." I have for a long time had some misgivings as to its applicability in production economics, in problems requiring a generalization from micro-economic problems to the broader field of public policy. Lately, however, the fashion of employing the theory has spread to land economics. Inasmuch as land economics has always by definition been concerned broadly with "social theory," the attempt to generalize from firm analysis, marginal productivity theory, and other parts of the model employed by modern neo-Hicksians, appears to this observer to be a loss rather than a gain.

Most land economics research endeavors to ascertain ways in which resource-use can be improved. Let us investigate whether in such studies we can safely use the neo-Hicksian model now accepted as "standard" by the great majority of economists:

The goal of economic organization is efficiency and welfare. Increases in physical goods and services are accepted as the *measure* of achievement toward these goals. Although most theorists demonstrate a nodding acquaintance with the non-physical and abstract components of welfare, the non-measurability of such components requires that they be omitted from consideration. One sub-branch of the profession accepts the belief that the "indifference" concept makes such measurability unnecessary anyhow. On this latter point there is considerable disagreement; however on the matter of the basic goal being efficiency and welfare in physical terms, there is a long history of agreement stemming from the eighteenth century. The careful writer thus begins his conceptual introduction with a phrase such as the following: "Efficiency in the use of resources is judged by the total amount of goods and services that are produced with a given set of resources and technical knowledge." So far, no argument.

To test any particular economic situation against another, and against the efficiency welfare goal, some system of measurement must be used. Monetary amounts are the most convenient, and in most cases the *only* measurable, factors. The thing that is *maximized* in most economic models is therefore monetary amounts. Economic scientists have not been able to devise realistic (and necessarily very complex) models dealing with amounts of diverse physical goods, much less abstract satisfaction-welfare feelings. There is general agreement, with appropriate qualifications, that the maximization of the monetary "equivalent" of goods and services is an acceptably good approximation to physical maximization. The careful writer thus continues.

> "If the economic system is one in which the assumptions of the accepted theories of economic value hold (perfect competition, factor mobility, and economic knowledge), then value in use is correctly expressed by price. This must be so, because if price and value should diverge, the system would move to a point of equilibrium where price and value would once again have to coincide. Therefore, a system of economic logic in which net incomes of entrepreneurs are

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maximized will necessarily describe the conditions of a real world system in which goods and services are at a maximum."

So far, still no argument. But now we must face reality.

Before the mid-thirties, theorists considered that using monetary amounts to represent goods and services constituted no serious handicap in bridging the gap between theory and reality. There was little disagreement with the proposition that traditional economic theory was an acceptably accurate description of "basic" forces in the real world. In the strict logic of the theoretical system, a maximization of money values did automatically guarantee a maximization of physical goods and services and the optimum employment of all resources. The careful writer would continue:

"We now make anotner assumption;—that the real situation we are investigating is one in which the assumptions of the traditional theory rule, or at least one in which reality is 'near enough' to the assumptions that 'tendencies' can be reasonably expected to exist. We must be willing at all times to bear the burden of proof on this point."

Let us look at an astute modern theorist and see how he handled the problem. Hicks, in *Value and Capital*,[1] was careful in observing the limitations of the logical system he was elaborating.

A. On p. 78 Hicks points out that he intends to extend the traditional theory of value so that it becomes a "theory of production." This was a logical aim. Value theory had up until the time he wrote been primarily concerned with a system in which sellers and buyers met in the market; the problem of *producers*, separated from buyers by a period of time, had not been adequately covered into the theory.

B. On p. 84 Hicks acknowledges that for his development of ideas to be logical we *must* assume that the departure of our real-world situation from "perfectly competitive markets" is very small. To be better understood, Hicks should have said that the departure from the *three* assumptions of classical economics must be very small: perfect competition, perfect mobility of resources, and perfect knowledge—but of course assumptions two and three are included in a broad, comprehensive definition of "perfectly competitive markets." The complete recital of assumptions should, in my opinion, be repeated every time an economist writes on this subject; otherwise, he is bound to be influenced by the current highly-publicized "proof" of a considerable amount of price or non-price competition in the market to neglect the equally important assumptions as to factor mobility and the economic man. Hicks admits that if departure from the traditional assumptions is *not small, we cannot analyze much using the methods of economic theory.* (p. 85)

C. On p. 99 Hicks takes another major step. With what we have learned earlier in his theory of the equilibrium of the firm, we can set up "an economic system," in which the "price system" not only regulates exhange, but also regulates *production*. Of course Hicks means that the price system, without the necessity of government interference or any other human activity except rational economic responses to price, regulates production "properly." The tie, back to maximization of goods and services, remains quite clear to Hicks.

D. However Hicks acknowledges (p. 99) that monopolistic competition and state intervention are fatal to his theory—"economics" can not handle them. "Economics," that is, the logical system Hicks considers to be "economics," in

[1] J. R. Hicks, *Value and Capital* (New York: Oxford University Press, Second Edition, 1946).

which prices serve properly to regulate the system, cannot handle situations in which *powers* other than price and rational response to price are permitted to exist.

E. In later chapters, Hicks fits his "theory of the equilibrium of the firm" into the "theory of general equilibrium of exchange," which is of course part of the "theory of general equilibrium of production." The latter theory is a "value theory"; that is, a description of the conditions under which the relationship between price and value will be "correctly" maintained in a price-regulated competitive economic system. In this entire system, the price mechanism, working through the ordering of preferences by the humans involved, is capable of bringing about what he calls "stable, dependable, equilibrium solutions." The great merit of Hicks's development of the theory is that his tie to "physical efficiency" is logically strong. He believes that he has laid down "a pure theory of economic dynamics," its laws, its regulators, its principles. (p. 283) ". . . . the system of economic relations we have been studying is nothing else but the form of a progressive economy." (p. 302) There was apparently no doubt in Hicks's mind that the parts of his system of price-regulated activities fit into a consistent whole, the goal of which is productive efficiency in the goods-and-services sense.

Now let us take up some of the noteworthy attempts of economists in recent years to apply traditional economic analysis to problems in land economics: "to resource conservation generally and soil conservation specifically."[2] The Iowa State College bulletins by Heady and associates are excellent examples, not necessarily because they are the best in this field, but because the statement of the theoretical setting is in most of them presented in a particularly straightforward manner. Implicit in the entire series of bulletins is the almost-unquestioned belief that maximization of monetary returns to the individual firms under study will automatically produce optimum social benefit.

These ideas are perhaps most clearly stated in the Heady and Swanson Bulletin entitled *Resource Productivity in Iowa Farming with Special Reference to Uncertainty and Capital Use in Southern Iowa.*[3] The first page of the test (p. 753) has three paragraphs. The first paragraph sets the stage. It talks about *efficiency*, the efficiency that has been brought about by applying the results of scientific research, new crop varieties, new machines. This efficiency led to great increases in the production of goods and services. The authors say: "One criterion for judging the performance of an economic system is the total amount of goods and services that are produced with a given set of resources and technical knowledge." So far no argument, except possibly one of emphasis. Instead of saying "one criterion," I think the authors could have well said "the major criterion"—the other criteria they mention, such as speed in adopting the results of scientific research, new crop varieties, and new machines, are actually subsidiary means of achieving the major goal, production of goods and services.

The very next sentence after the one quoted is the site of the error, however. The authors say: "*Economic analysis* gives the conditions which must hold true if the total product or return is to be at a maximum for a given quantity of resources. If the value of total agricultural production of Iowa is to be as great as

[2] W. G. Murray, "Foreword" to *Principles of Conservation Economics and Policy* by Earl O. Heady and O. J. Scoville, Iowa Agricultural Experiment Station Research Bulletin 382, Ames, 1951, p. 364.

[3] Earl O. Heady and Earl R. Swanson, *Resource Productivity in Iowa Farming*, Iowa Agricultural Experiment Station Research Bulletin 388, Ames, 1952.

possible from the resources in use, each farmer must arrange his resources so as to yield the greatest value of product." Bingo! The transition from physical goods and services to maximization of money incomes in the real world of Iowa farm life has been made without a word of warning to the reader. And the rest of the bulletin maintains the illusion. "Economic analysis," in the words of the authors, can give us solutions, can tell how, when farmers maximize their net incomes (2nd paragraph), by shifting their various resources so that the marginal money-value product of a given resource would be the same in all of its alternative uses within the farm (3rd paragraph), the resources are thereby automatically used so that the total *amount* of goods and services for society is maximized (1st paragraph). Now this chain of logic holds only if the classical assumptions hold true. However, the Iowa authors do not devote even one small paragraph to claiming that the real world situation is "near enough" to perfect competition, factor mobility, and *homo economicus*, for us to use their analysis to help formulate agricultural policy.

The "theory of the firm" has been widely used, and perhaps misused, in production economics. One agricultural economist at a land tenure conference expressed what is perhaps the main reason for this. "The economists who have applied the 'theory of the firm' to farm management have limited themselves to the task of outlining the methods by which farmers would maximize profits, *assuming that is what they want to do.*" If this is so, then I would object that they have not applied the "theory of the firm." Perhaps we would be able to see this more clearly if we use the correct title for the theory. It is not simply a theory that says a firm will always try to maximize its money income—we did not need a "theory," or at least an economic theory, to say that. That was said adequately enough in the original assumption with regard to man being "economic." What the theory really is intended to do, according to Hicks, is to serve as a theory of the *equilibrium* of the firm within a general theory of value, not outside. The entire logical exercise of Hicks and his followers was directed at proving that rational human response to price, if allowed to take place in a free economic system, would bring about, automatically, through the achievement of equilibrium positions, the broader social goals of efficient resource-use.

If the theory of equilibrium of the firm is removed from its context of value theory, what remains is little more than a particular type of cost-accounting or budgeting. It is not part of an economic theory if "theory" has its customary meaning in "traditional" economics—if it has the meaning Hicks intended: to lay down "a pure theory of economic dynamics, its laws, its regulators, its principles," (p. 283) . . . . "a set of guides for the self-regulation of a progressive economy." (p. 302)[4]

[4] The following clarifying remarks are added at the suggestion of Professor Don Kanel: The definition of "theory" is important here. Traditional economic thought seems always to have demanded that "theory" be a mutually consistent body of thought, in which natural laws (themselves too often unquestioned), working without significant interference, "cause" the elements included in the process under study to operate in ways which can be predicted. Definitions of "theory" in social science outside of traditional economics, for example in the scheme of John Dewey, usually do not include such dependence on natural law. Under such a definition, almost any organization of ideas set up for the purpose of directing research can be called a "theory." In the research that follows, the theory itself will be tested for validity, and modified where necessary. This more "scientific" use of the word "theory" is, unfortunately, not what is meant in the research here under criticism. (See John Dewey, *Logic, The Theory of Inquiry* (New York: Henry Holt Company, 1938) pp. 504-5.)

I am criticizing the customary use of "the theory of the firm" because it labels policy alternatives with welfare indexes. I am not arguing against the use of the *concept of maximization* to direct observation of behavior or to analyze anticipated response to proposed policies. It might well direct attention to interrelations between men that arise out of their choices to sell, to buy, to hire, or to produce different commodities, whether this is done competitively or not.

For some time, and particularly since the 1930's, economists have amassed considerable data attesting to the fact that competition is not free, factors are not mobile, and man is not economic, to the extent demanded by traditional value theory. Yet the majority of economists continue to march to the traditional theory[5] perhaps because their investment therein of time and professional research is so great that they have reached the point of no return. Those who deal in politico-economic policy often attempt to force the modern industrial world to fit their theory; another group engages in statistical studies of the extent that certain elements of competitive struggle still exist in "big business," and concludes that modern competition is even better than the classical type; and a third large group ignores the entire controversy and spins out interminable refinements of the tradition. Land economists, for the most part, have always been forced to be more realistic. They have long been aware of immobility of resources; they have recognized the realm of bargaining, as for example between landlord and tenant, where there is no one position at which the satisfactions of both parties can be maximized; and they have recognized both that the competition is imperfect and that the bargaining power is unequal in most of the situations they study. This observer hopes that by attempting to use the shiny and glamorous tools of the more exact of the economic "scientists," they will not lose their heretofore eminent claim to realism.

[5] For an amazingly candid testimonial to the belief that traditional theory is right because most professional economists believe it is, see the paper presented by George J. Stigler at the 1953 meetings of the professional associations, "The Economist Plays with Blocs," *American Economic Review*, May 1954, p. 10: "On the more comprehensible theory that most of the rest of the regiment marches to, prices that do not clear markets have socially undesirable effects on the allocation of outputs and resources at all times."

Mechanics of the Urban Economic Base: Causes and Effects of Change in the Base Ratios and the Ratio Elements (I)

By RICHARD B. ANDREWS*

THE concept of the urban economic base while of relatively recent origin as hypothesis and theory already shows encouraging signs of great practicality in the hands of the city planner and research worker. However, the role of the concept as a working tool capable of fairly wide applications is definitely of a potential nature. This is true because in the present state of knowledge the view of the urban economy presented by the theory is essentially a static one. Base ratios which quantify the principal elements of the urban economy, according to the theory, tend to show the state of a community at one moment of time, a still life as it were, of a local economy. While understanding of urban structure is improved by this approach little is contributed, save by rather tenuous assumptions in most cases, to an understanding of the dynamics of urban economies. This deficiency is highly significant in the fact that, as is generally recognized, the modern urban community is in a constant state of flux economically and socially. Therefore, if base theory is to make a meaningful contribution to the planning process of predicting the trend of a local economy and of ultimately controlling it a more complete exploration and testing of the assumptions relating to change in the base ratios of the urban economy must be conducted.

The most prominent of the assumptions or hypotheses which touches upon that aspect of the base ratio concept concerned with dynamics states that positive or negative changes in the quantitative size of the base will cause automatic parallel proportional changes in the other ratio elements over the long run.[1] It is further hypothesized that, although temporary short-run disturbances arise in the relationship of the ratio elements, they return in the long run to their original condition of equilibrium.

The principal objective of this paper and the two which follow it is to initiate a testing and questioning of the ideas surrounding base ratio dynamics. This "testing" will be restricted to the methods of *a prior* reasoning and the relating of known facts and other theories on urban economy operation to dynamics theory. This is considered to be a logical preliminary organizational step to ultimate field testing.

Since the details of ratio dynamics represent a dark unknown, since these details if properly surmised may test the broad hypotheses of base dynamics, and since detailed dynamics are the aspects of base theory with which city planners must ultimately work, much of the discussion in these papers will be focused on matters of that nature.

In outline the details to be discussed will be concerned with what occurs in a community during the process of qualitative as well as quantitative base change; with the influence of time in the process of base change; with the tendencies toward independent power of change on the part of elements in the ratios other than the base; with the degree of resistance to change on the part of other

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[1] Richard B. Andrews, "Mechanics of the Urban Economic Base: The Concept of Base Ratios," *Land Economics*, February 1955, pp. 50-51.

ratio elements when the base itself is changing.

Before entering a detailed discussion of the nature of base dynamics it is appropriate to define the base and outline briefly the character of base ratios.

The economic base of a community is composed of those activities which export goods, services, and capital to individuals or firms whose source of payment is outside the urban economic area under analysis. Service activities which operate as an economic complement to the base in each community do not export their goods, services, or capital but sell them to local firms and the local population—in short, an internal type of function. Base and service activities if measured in terms of number of employees and proprietors will when added equal the total employment of the community. If, again, employment is used as a measure it is possible to identify a ratio relationship between base and service activities, the base and total employment, and total population. The ratios are frequently discussed and used in an overall pattern which is referred to as the "base ratios." The pattern appears as follows:

B	:	S	: :	1	:	2
B	:	TE	: :	1	:	3
TE	:	TP	: :	1	:	2
B	:	TP	: :	1	:	6[2]

Varieties of Change in the Base Ratios

The subject of base ratio dynamics embraces at least three general varieties of change which are likely to influence the ratio elements and usually the ratios themselves:

(1) There is the "permanent" change from a base area norm. This situation may, for example, see a shift in the B to S relationship from 1:2 to 1:1½. Such a change may persist in a local economy and become permanent. This type of change which frequently evolves from qualitative changes in B may or may not alter all the other ratios in the pattern.

(2) In contrast to permanent ratio changes there may develop short-run or temporary shifts in the ratios often of a cyclical nature with a long-run return to the normal or typical community ratio.

(3) A variation of (2) occurs in situations in which the quantitative composition of each of the ratio elements may change without bringing about a change in the actual ratio relationships. As an example, in a community where the B to S ratio is 1 : 1 and the employment composition of these elements is 1,000 to 1,000 there would be no change in the community ratios if B and S moved almost simultaneously (in the short-run) to a 2,000 to 2,000 relationship. Nor would the TE to TP and B to TP relations necessarily change as long as the employment additions involved in-migrating family groups.

The varieties of ratio change described above will be woven into the discussion which follows. This discussion will be broken into three parts. One part will be concerned with what might be termed "external" causes of base ratio change. The second part will examine the causes of ratio change which are "internal" or largely local in their origin. The third and major portion of the paper will bring the causes into juxtaposition with varying effect patterns among the base ratios.

External Causes of Base Ratio Change Within a Community

The basic economic activities of any community are subject to both constant and periodic pressures that are the direct result of broader changes in economic and social conditions of the region or nation.

National Economic Cycles. Most familiar among these external influences over the base and hence over ratio change is the state of the national economy. Fluctuations of the business cycle can contribute

[2] These are representative ratios only. The ratios of actual communities will vary from these. The symbols are: B — base activities; S — service activities; TE — total community employment (B + S); TP — total community population.

significantly to both the quantitative composition of the ratio elements and the ratio relations themselves. Naturally, some types of bases are much more volatile cyclically than others. As is well known, the durable goods industries register relatively broad fluctuations. Consumer goods industries, on the other hand, are far more stable. Certain types of governmental operations particularly at state and federal levels induce either a stabilizing or an intentionally contra-cyclical effect when they conduct decentralized operations in many cities.[3] National defense policy accompanied by heavy decentralization of both heavy goods production and service activities can be a potent factor for qualitative change and either positive or negative quantitative change in a large number of metropolitan areas. The degree to which a base is specialized in one of the above categories or is diversified among them will largely determine the nature of its base ratio reactions at particular points in the course of national cycle fluctuations or shifts in defense policy.

Regional Economy Cycles. It must be remembered that regional economies within the broader national economy may show a certain independence of movement. However, the general pattern of ratio reaction to such movement or change will still tend to be set by the qualitative character of the base as described in the preceding section. A significant difference which exists between the effects of national and regional economic fluctuations on an urban base is found in the fact that where regional economies are experiencing a localized recession the movement of firms or certain productive factors out of the region may be stimulated: whereas if recession is a national phenomenon such movement would be less likely due to a substantial reduction of alternative opportunities. From this line of reasoning we may conclude that national, all-pervading fluctuations of the business cycle may influence positively or negatively B, S, and TE within a particular community but not necessarily TP. However, with the greater mobility which is possible in the regional situation all elements of the ratios including TP would be likely to change.

An appropriate commentary on cyclical movements of a national or interregional nature brings out another point which may very well influence the base ratios, namely:

> "It does not necessarily follow, however, that transmission of a cyclical movement through tne price system from cne area to another will result in similar price movements in both; changing prices in one area may rather result in output changes in areas which have relatively rigid prices."[4]

Another aspect of regional economic change involves seasonal cycles. There are, of course, many economic activities which undergo seasonal cycles on a broad national scale. However, there are, in turn, perhaps an even greater number which find their activity confined to a more restricted region or group of regions. This situation does not necessarily imply that there is present a heavy potential for change in the economic base of a community located in such an area. It is usually true that a seasonal base economy in a community is adjusted by counter-balancing in the off-season with other seasonal activity. This balancing does, nonetheless, become somewhat precarious where one of the seasonal activities is unstable or strikes a run of thin seasons. In situations such as

[3] Reference is not made here to relief programs *per se.*

[4] Phillip Neff, "Interregional Cyclical Differentials: Causes, Measurements and Significance", *American Economic Review*, May 1949, *Papers and Proceedings of the Sixty-first Annual Meeting of the American Economic Association*, December 1948, p. 117.

this the out-movement of base activity firms may not be the first indication of negative change in the base. The local labor force seeking more stable employment may move from the area, thus increasing base activity labor costs and thereby bringing about weakened competitive position, firm failure, or movement.

Specifically, in the case of recreational industries which operate seasonally, a succession of bad seasons in terms of weather and hence trade may encourage shift of the firm without the interposition of a prior shift of labor. A similar situation can also develop for communities in which the handling of regionally-produced fruits and vegetables may represent an important part of the base. This type of influence is closely allied to the next major category which is concerned with the causes for locational shift of industry.

Shifts in Industrial Location Patterns. Among those external economic factors which are likely to have a marked effect over the elements of the base ratios are the conditions which influence the frequently delicately balanced forces of industrial location. Basic activities which might commonly be classified as "non-industrial," i.e., educational, governmental, religious, and pure research institutions, are also subject to the pressures which call for locational readjustments but are, as might be expected, less sensitive to these pressures than are the regular profit-motivated branches of industry.

The conditions which bring about locational shifts need only be mentioned in a general way here since they are already familiar in detail to all planners and economists. Locational influences which may be roughly classed as being external in nature include markets, raw materials, transport rates, transport net alterations, and the like.

Market patterns of a regional, national, and international character are known to be relatively fluid over the long run. Conditions contributing to population mobility, particularly on a national basis, will influence market patterns in a decided manner. Regional and international shifts in both tastes and purchasing power are also certain to have a varying range of geographic influences over basic activities which have a strong market orientation.

A different aspect of the market orientation question is found in retail trade. That portion of the retail trade of a community which is basic in nature is frequently subject to the more localized pressures of intercommunity competition. Such competition can, of course, take many forms ranging all the way from price and quality of goods and services to comparative traffic and parking difficulties. Unlike a manufacturing establishment which might be more predominantly basic than service, questions of long locational shift do not as frequently enter into the policies of retailing operations. When local patronage is dominant for the retailer, as it most frequently is, he tends to view the patronage of outsiders as an attractive addition to trade volume. The decline of this extra-local area patronage will be missed but would not usually dictate a locational change. Declines, or for that matter increases, in his extra local area patronage will, of course, influence his hiring policy and by indirection the volume of local spending on other service establishment output thus influencing to a minor degree the base ratios. In those situations, however, where extra-local area trade is dominant as it would be for a trading center then locational shift becomes a stronger possibility. In the opinion of the writer these shifts would be rather pronounced for chain operators or service establishments

with small or no local investment in the real estate aspects of their business. For the traditional merchant of the trading center, however, it seems reasonable to believe that in the face of patronage decline retrenchment or complete cessation of operation would be more likely than a locational shift. Hence, from at least one point of view it might be concluded that the retail and personal service elements of a community's economy may exhibit somewhat more resistance to the advantages of locational change than other classes of industry. The significance of this situation for shifts in the base ratios and any quantitative or qualitative changes that may take place in them is, perhaps, self evident.

Raw materials as a geographical orientation guide may work from either the external or internal side. Raw materials would be considered as an external influence over base ratio elements in the event that the raw material source was beyond the economic limits of the community. Exhaustion of the source, price shifts in the raw material, institutional restriction or step-up in supply, and employment of substitutes may all or individually play an important role in a geographical shift or more intensive operation of the base activity employing the raw material. In these circumstances it is not necessary that the base activity be raw material oriented. Definite orientation toward raw materials will tend, of course, to stimulate both a quicker and more drastic reaction. On the other hand, the base activity which is not specifically oriented to raw materials may well respond by a locational shift or change in volume of production if a change in raw materials' availability seriously disturbs its balance of costs and revenues.

Costs of procurement and distribution are also a part of the pattern of locational dynamics as they affect base activities. In this frame of reference procurement costs include not alone the costs of physically moving raw materials to the point of processing but also the overhead costs of purchasing, handling en route, etc. Similarly, distribution costs involve more than the cost of physical movement of the processed goods to their markets. Here the supplementary costs of distribution may well include special correspondence and communication, advertising, sales, storage, and packaging expense. Whereas the core costs of procurement and distribution are those of physical movement the supplementary costs and changes which are likely to occur in their patterning may often be influential in decisions relating to change in base activity location and /or production volume.

Transport nets as an external influence for change in the location of base activity emphasize a rather specialized aspect of the process of procurement and distribution. Location of a base activity on a transport net of rail, truck, water, and air routes may be finely calculated for minimum costs of procurement and distribution which may in turn be tied to vital competitive considerations of perishability, delivery speed, and the like. Permanent changes in the net, identifiable with switching policies, junction interchanges, or reduction in route alternatives, may suggest movement of portions of the base activities to a more profitable location on the net, or again a positive or negative shift in local production policy.

Technological and Institutional Innovation. Base activities of a community are subject to a wide range of largely unpredictable influences which are associated with mechanical innovation and change, and with innovations within our institutional

framework of laws, rules, and customs both economic and social.

Most of the influences of this general type are quite familiar. Within the mechanical field those devices most deserving of mention are the automobile, the airplane, the mechanical refrigerator and deepfreeze, the septic tank, teletype communication, machine tools, radio, television, etc. Among the more important institutional influences can be listed recent forms of mortgage, and installment credit, changes in industrial financing techniques and legislation, sweeping high court and administrative board decisions such as those involving the basing point system, interstate freight rates, unemployment compensation, and utilization of government-owned or controlled natural resources. Institutional change also involves changes in marketing, advertising, and production techniques.

While we recognize the presence of changes such as those just described we are not always aware of the manner or degree of their influence over the base activities of a community. In many cases the pertinence of such change will depend on the location or character of the base activities involved. In other situations the influence may be highly generalized, taking little regard of location or individual base characteristics. In any event the influence may be quite drastic in either a positive or negative direction for a particular urban community.

Secular Change. As contrasted to the shorter term general influences just discussed there is the field of long-term or secular change. While this type of change can be foreseen more effectively by the planner because of its greater extension over time it does provide some challenging decisions in the field of land use control as the result of inevitable change in the qualitative composition of the economic base of the community and in the ratio relationships. There is, moreover, the disturbing possibility that there may occur an accelerated telescoping of secular change factors traceable to the effects of technical and institutional innovation.

The familar broad aspects and effects of secular change on an economic base have been well expressed by Hoover when he says:

> "Specialization in the so-called 'secondary industries' (manufacturing and mining) is not the final stage of regional or national economic development. With higher incomes an increasing proportion of expenditure is devoted to commercial, transport, administrative, professional, and personal services."[5]

Hoover might also have mentioned as a causal factor in this connection the fact that as industry matures the breadth of its marketing activities and the competition for markets expands greatly. This will have much the same sort of qualitative effect on the base and service activities of a community as those described in the quotation.

Some of the aspects of technical innovation referred to earlier might also be brought under the heading of secular change when their long-term aspects are considered.

Secular trends of importance to the economic base and base ratios are perhaps most evident in the evolution of social customs and conditions, e.g., family size, span of working years of the individual, age of marriage, age structure of the population, racial distribution and rate of absorption, birth rate, and position of women in the labor force. Some of these ideas are emphasized by McLaughlin:

[5] Edgar M. Hoover, *The Location of Economic Activity* (New York: McGraw-Hill Book Company, 1948), p. 149.

". . . . The relationship between total population and the working population may be affected by change in leisure, in unemployment, in school attendance, or in the sex and age distribution of the population."[6]

A combination of secular change with regional influences may also occur to bring about significant quantitative shifts in the ratio components. These shifts may, of course, also alter the ratio relationships. This particular aspect of secular change is described by Kidner and Neff:

"To use a Keynesian term, there may well be regional differences in the marginal efficiency of capital and, if this be so, those regions undergoing strong secular growth will certainly be the favored regions. The favorable cost differentials arising from the widening extent of the market, the economies of scale which make themselves apparent in a region serving a larger and larger market all tend to provide an incentive for investment decisions to result in the expansion of industry first and in largest measure in those areas characterized by strong secular growth. This line of argument suggests that when a significant volume of investment is being undertaken, attesting to generally favorable anticipations, it will be relatively concentrated in the expanding areas whereas in periods where anticipations are pessimistic, no significant investment will be undertaken in the economy."[7]

It should be noted that no assumption is made at this point that secular change and secular growth are identical phenomena. Secular or long-run growth of industry in a region or in a particular community will, because of its long run nature, tend to parallel secular change factors. At points such as this it is very difficult to distinguish between external and internal influences over the base ratios. For example, it is undoubtedly true that, as Kidner and Neff suggest, secular growth of economic activity within a particular community is a reflection of external secular trends of the region in which it is situated. On the other hand, individual communities within a region will show rates and patterns of secular growth quite different from a regional average. This divergence from a regional average or tendency may well find its explanation in influence pressures which are of local origin.

Internal Causes of Base Ratio Change Within a Community

Clearcut distinctions between external and internal causes of base ratio change are frequently difficult to establish. However, it is important to the city planner to clarify this distinction to the best of his ability inasmuch as his potential power to control change and therefore the community economy is associated principally with local phenomena.

The discussion which follows will not attempt to make an exhaustive list of local influences over base ratios. This would be too formidable a task. It would, moreover, not be of more than academic interest to the planner. Consequently, description and analysis will be confined to what this writer considers the most likely or frequent causes of internal change that may influence the base and the base ratios.

This discussion will not include factors of internal change which can be classified as conscious policies to control the local economy. Such situations would include not only action taken by the local planner but also action taken by local chambers of commerce or specially organized citizen groups to inject quantitative and qualitative changes into the economic base. Policies of this variety are usually prompted by conditions which have already developed or are likely to develop from external or internal causes.

[6] Glenn E. McLaughlin, *Growth of American Manufacturing Areas* (University of Pittsburgh, 1938), p. 38.

[7] F. L. Kidner and P. Neff, *An Economic Survey of the Los Angeles Area* (Los Angeles, California: Haynes Foundation, 1945), p. 144.

Secular Change. The nature of local secular change was touched upon in an earlier article as a partial explanation of ratio differences among cities[8] and was also stressed in its external aspects previously in this article.

It must be recognized, however, that the secular shift of a community economy focus from manufacturing to commercial activity may be not alone a reflection of the long-term trend of the national economy but also an independent trend of the city itself traceable to age and growth in size. While B and S will increase quantitatively in this local process of secular change their ratio relationships will also be altered. There will be a tendency for the ratio of S to B to increase as the local economy matures. If employment is used as a measure in the ratios there will, consequently, develop a change in the relation of B to TE. The relation of B to TP, and TE to TP may also change as the consequence of an aging of the local population and the more frequent occurrence of retirement families within the community.

The types of local secular change thus far suggested are what may be classified as qualitative changes in the economy. These are accompanied by quantitative change. However, it must be kept in mind that quantitative and qualitative change can act quite independently of one another. For the planner, qualitative change in the base is likely to present the most complex difficulties with or without quantitative change. This is due to the fact that changes in the makeup of the base are certain to influence the social pattern of the community and such changes may well, in turn, alter the ratio relationships.

[8] Richard B. Andrews, "Mechanics of the Urban Economic Base: The Concept of Base Ratios," *Land Economics*, February 1955, p. 50.

Local Industrial Location Factors. Perhaps the greatest internal potential for change in the community base and hence in the local economy lies in local industrial locational factors. The external potential for change from this source was covered earlier in the paper. The general idea stressed there was that the location of industry and its consequent profitable and/or efficient operation is in large part dependent upon a proper balancing or arrangement of locational factors. Included among these locational determinants are raw materials, markets, and the broad productive factors of land, labor, and capital. Whereas raw materials need not be directly identified with the locality in which an activity is located the productive factors are almost invariably so associated.

It is, perhaps, patent that when parts of a community's economic base are strongly oriented to raw materials which lie within the community expansion, exhaustion, or impairment of this supply, may force the movement of the industry or a drastic change in its production policy and hence quantitative or qualitative nature. Extractive industries are the extreme example of this situation. The planner's role relative to this factor of change is clearly one to be expressed in terms of possible conservation measures or compensatory activity. In any event, the long-term effect is one of qualitative change possibly accompanied by quantitative change and a relatively permanent shift in the ratio relationships. Expansion of local raw materials supply by discovery would tend to maintain the base ratios or possibly increase the size of the elements of the ratios.

Potentialities of change traceable to the productive factors are so numerous and complex that the scope of this part of the subject can only be suggested here. The traditional factors of land, labor, and

capital need considerable refinement of definition for the planner's purposes.

Land as a productive factor involves orientation questions of price, geologic suitability to productive processes, supply and cost aspects of electric power and water, land supply available for expansion, zoning policy, real property tax rates, and the volume and quality of public services important to the productive process. Climate is also a legitimate element of the land factor. Its importance in many industries, notably textiles, is well known.

Special aspects of the land factor are focused on the field of internal transport movement. Locational decisions frequently swing not only on the availability of but also the efficiency of local transport, terminal and switching facilities, and public storage. Closely associated with conditions surrounding these facilities is the question of ease and efficiency of local traffic movement. Difficulties surrounding such movement in central city areas have become all too familiar in recent years. Locational adjustments to rising traffic movement costs have most frequently taken the form of dispersal of activities from the center but within the metropolitan area. However, these moves in certain circumstances may be to points outside the metropolitan and base area.

Labor as a productive factor also includes a congeries of variables. Among the more important aspects of this field are the adequacy of supply in quantitative and qualitative terms, the price of the supply, the degree and strength of unionization, attitude of the industry toward unionization, volume of fringe benfits necessary to attract labor, social habits of the force and the like.

Capital in its locational aspects relative to production involves the usual supply and price aspects of loanable funds for both short- and long-term financing. From another point of view it can also involve the supply, price, and practicality of using machinery in a particular locality.

It should be emphasized at this point that the forces for ratio change in a community can be either positive or negative in terms of competitive position with other communities. From what has been said thus far the impression may well have been created that the internal basis of ratio change is solely negative in that economic activities may leave the community because of shifts in cost or efficiency patterns.

The extent to which any of the productive factors may become the source of change in the base and the ratio relationships is dependent upon a number of different situations.

On one hand much depends upon the degree to which difficulty has arisen for an industry in connection with a particular productive factor. Early development of factor trouble may merely serve as a warning indicator for a city planner before deterioration of conditions surrounding that factor have reached serious proportions.

Significance of productive factor difficulty in its relation to the locational policy of a particular economic activity is principally dependent upon the importance of the specific factor or its subcomponent in the cost and profit structure of private industry or its influence over the efficiency goals of non-profit organizations.

In this same connection it should be reemphasized that each cost factor is but one element in a cost complex. Since this complex is often delicately balanced locationally in highly competitive fields slight factor disruptions if persistent and neglected by public authorities may lead to locational readjustments.

It is appropriate to repeat mention of an external factor at this point since it has direct relevance to the argument. It may occur that in a particular community no change takes place in the price or supply status of productive factors. However, changes do take place in other communities thus placing the subject industry and city at a competitive disadvantage and encouraging locational adjustments. Though an external influence for change this is to a certain extent controllable by certain limited local changes that can be made to meet external competition.

A final comment that should be made on locational policy and base ratio shifts involves the economics of local linkages.

If the beginning or head of an economic production or service chain due to significant changes in orientation factors shifts its geographical location all or part of the associated links and industry complements within an urban economic area may be prompted to shift their locations to suit. The degree of sensitivity to locational change on the part of any one link or complement will depend on the degree of concentration of its markets and raw materials in relation to the other links. Mobility will, of course, be influenced by many other factors as well.

It must be noted that no assumption is made here that links are always so closely associated that they must function together in the same urban economic area. In fact, some links, it must be recognized, are subject to orientation influences which may not affect other links in the same chain. Complements, however, do usually seem more closely associated geographically with production links, particularly in the commercial finance, insurance, storage, and goods handling fields.

Hoover makes an observation relative to this whole concept which, though it does not specifically relate to urban economic areas, can be applied in principle to them.

"The effects of a lasting major locational change are almost never confined to a single industry. Even if the technical development or other 'initiating' factor of change applies directly to only one industry, that industry's response will alter the basis of locational preference for several others. Their responses, if any, will do likewise, and a chain of locational repercussions is thus set in motion that may change the face of a continent."[9]

Corporate Production Policy. Changes in local corporate production policy in terms of their degree of influence over base ratios are of great variety and range of intensity.

A change in the nature of the product to be produced may induce several types of reactions. The producing firm may find it advisable to leave the area because of altered raw material, market, and productive factor orientations. Or with a change in product the firm may stay in the community and alter its factor demands, particularly those of capital and labor.

On the other hand, the firm may continue to produce the same product but alter its application of the productive factors. A case in point would be increased mechanization with possible labor displacement and at least a short-run alteration in the ratio relationship.

Another phenomenon which becomes increasingly common as specialization intensifies within our economy is subcontracting or purchase of parts formerly produced by a firm. Cessation of local production of the parts sub-contracted outside the area may lead to dislocations of varying seriousness. An indication of the general results of this type of policy are apparent in the following quote:

". . . . Ford has generally chosen to erect a new plant in Detroit rather than to acquire

[9] Hoover, *op. cit.*, pp. 151-152.

an existing facility elsewhere . . . . Because of greater dependence on independent parts and equipment producers, however, Chrysler employed only 65,000 persons in 1940, or slightly more than half as many as Ford."[10]

Where subcontracting becomes the principal policy of a very large corporation, such as certain firms in the automobile production field, there may result a clustering of the subcontracting firms around the major purchaser. As a consequence of this localization or concentration of linkages there may not occur the possible negative shifts suggested earlier but, rather, a strong positive quantitative shift in the elements of the base ratios with possible accompanying qualitative change. The resulting duplications in clerical and managerial personnel emerging from a situation such as this might work toward a slight quantitative increase in B and S and a qualitative shift in S. Ratio relationships would probably be disturbed on only a short-term basis.

Local Innovation. A highly intangible element in this discussion of internal or local causes of ratio change is to be found in the potential effects of local innovation particularly mechanical invention. The unpredictability of invention makes a discussion of it largely academic from the standpoint of the city planner. Ratio changes can, however, certainly be anticipated if the innovation is likely to alter the qualitative character of the ratio elements, particularly the base element. Despite the admitted intangibility of this internal factor there are certain clues which the planner may employ which will at least indicate the likelihood of innovation. These clues develop from at least two sources. If there is a local tradition of innovation along relatively special lines the planner may be led to anticipate others which could lead to economic results similar to those produced by their predecessors. Another basis for anticipating innovation somewhat resembling the one just described refers to organized research. Local corporations with highly developed industrial research programs can give the planner a much clearer idea of what may be expected in the way of local economy change providing the research is a success and, of course, can be made known in its preliminary stages to the planner.

[10] Detroit City Plan Commission, *Economic Base of Detroit*, (Detroit, Michigan: 1944), p. 10.

Conclusions

In view of the fact that the urban community is a highly dynamic social phenomenon, particularly in its economic aspects, the city planner is faced with the challenging problem of understanding the specific causal background of this dynamism. The ultimate purpose of understanding is control leading to those social and economic ends which the community deems most appropriate.

As is apparent from the topical scope of this paper the range of causal influences for change over the local economy and, consequently, over the base ratios is extremely wide and varied. Such a range of variables may appear impossibly formidable to the planner. However, an organized approach to the problem indicates that it is actually of manageable proportions.

The practical organizational approach for the planner might well be the one followed in this paper. His first step could be that of distinguishing external from internal causes of change in the community. Only, of course, instead of generalizing his approach he would be concerned with specific influences of the past, present, and future within his community.

When the planner has once classified the potential sources of change which may be expected to influence his local

economy as between external and internal he might make a further classification under each of those headings. This classification would be one that segregates causes by the time element involved according to short-run or long-run effects. The time element involved particularly as it reflects the rate of change is of peculiar importance to the planner. In general, the external influences will tend to be of the long-run variety but the internal or local influences are definitely a mixture that ought to be segregated as clearly as possible. A short-run versus long-run segregation would also give the planner some idea concerning the relative permanence of the quantitative and qualitative changes and actual shifts in the ratio relationships. Again, in general, it may be said that the short-run influences may tend to yield less lasting changes than the long run. However, the exceptions to those generalizations are very important to identify.

Yet another approach to be taken by the planner is an identification of those influences in connection with which he has some independent power of action toward either discouraging or promoting their effects over the general economic welfare of the community. As between the external and internal phases of the problem he has, no doubt, the greater degree of control over the internal. This does not suggest, however, that he is completely helpless where external influences for change are involved and he should acquaint himself with the techniques of action, however limited, that are available to him in this direction.

A final aspect of the planner's handling of this problem should be the traditional one of drafting a priority list. In this situation the priorities would be based first on the degree of independent action possible, second on the immediacy of the change expected, and third on the breadth of influence of the change expected over the community's economy. With organizational tools of this kind the planner can go far in coping with the economic dynamics of the modern city which have often, thus far, been so baffling to him.

It will, nonetheless, be the duty of the research specialist to perform extensive investigations into the effects of these varied causes on the base ratios before the planner can proceed with any great degree of confidence in drafting, for example, an action priority list.

In the August issue the author will explore the subject of urban economy dynamics as it relates to the base ratios in more detail: specifically, the precise nature of the ratio changes that may be expected in varying circumstances will be analyzed. *Editor*

Reports and Comments

The Accumulation of Wealth in the Form of Land-Ownership in Underdeveloped Areas

IT has been frequently noted that in many parts of the world, and especially in the great underdeveloped areas of Asia, the customary form in which wealth is accumulated is in the ownership of land. It has, moreover, been supposed that the accumulation of wealth in the form of land holdings is an alternative to the accumulation of industrial capital. Hence the investment in the purchase of land has been looked upon as a diversion of investment from the creation of industries with all that this implies in the training of manpower, in the construction of plant and facilities, in the manufacture of machines and equipment or in the purchase of these from foreign sources. Therefore, the accumulation of wealth in the form of land ownership has been advanced as one of the reasons why these underdeveloped communities have failed to industrialize and to raise productivity at a rate or in a manner akin to that which has characterized the growth of industry and the increase in productivity in other parts of the world. Thus Roland Renne, writing on economic development in Asia, suggests that the "investment pattern is one in which wealth is held in the form of land, and the accumulation of capital is used to bid up land values rather than for productive investment of the sort which would diversify the economy, increase national production, make possible higher living levels, and improve economic stability."[1]

It will be the purpose of this paper to consider the relationship of the accumulation of wealth in the form of land ownership to the rate of industrialization, of real capital growth, and of technological advance generally.

[1] Roland R. Renne, "Land Tenure Reform as an Aspect of Economic Development in Asia," *Economics and the Public Interest*, editor Robert Solo (New Brunswick, New Jersey: Rutgers University Press, 1955), p. 302.

Wealth Accumulation and Net Capital Formation

It is first necessary to suggest a distinction between the accumulation of wealth, in the sense that it relates to the actions and equities of the possessing classes, and the accumulation of real capital in the sense that it relates to the growth of the production-potentialities of a particular community. By the accumulation of real capital we must mean such net additions to the apparatus of production and distribution as would tend to increase the total output capacity or the per capita productivity of a particular community. By the accumulation of wealth we mean the increase in the *claims* on commodities, inasmuch as these claims are held by individuals of a community and are considered to be realizable by the members of the community. The accumulation of wealth and the accumulation of real capital may be related inasmuch as an increase in the quantity of claims brings about or is caused by an increase in the potentiality of the community for producing the commodities to be claimed, but the accumulation of wealth and the accumulation of real capital are not identical and are not necessarily linked. It is possible to increase wealth indefinitely with no corresponding increase in real capital so long as there is no attempt at a net liquidation of these additional claims. A familiar case of wealth accumulation with no corresponding increase in real capital is to be found in the securities markets of the world. The value of existing securities may be bid to very great heights with no necessary effect on the accumulation of real capital. To the individuals possessing them, the stocks which are owned represent wealth, i.e., represent realizable claims which *ceterus paribus* may be converted into cash by the possessing individual and used for the purchase of all marketed commodities. And, for the community as a whole as well, a rise in the value of securities would represent an increase in

wealth in the sense that the term is used here, but this rise in the value of securities would signal no necessary increase in real capital and (hence) in the productive potentiality of the community. The net induced increase in wealth (value of claims) would remain extant unless (or until) there was a *net* liquidation of these claims, i.e., a situation where the securities which possessors desire to realize upon is in excess of the securities which others wish to acquire. When this occurs the value of the securities must decline and wealth be diminished, again with no direct or necessary effect on the accumulation of real capital. The accumulation of wealth in the form of land ownership is quite analogous.

The use of cash surpluses to buy land forces up the value of land in the same way as the use of cash surpluses to buy securities forces up the value of existing securities, in both instances with no direct or necessary effect on the accumulation of real capital. This is strictly true only inasmuch as is considered bidding on existing securities or on a fixed quantity of land. The statement must be qualified inasmuch as is considered the effect of a higher market value for securities in inducing a new inflow of securities, or the effect of higher land prices in increasing the quantity of cultivated land. The bidding up of the value of securities, hence inflating the wealth or "claims" of those possessing those securities, is itself without effect on the accumulation of real capital but there is implied here a condition wherein those interested in the accumulation of new real capital can do so on terms more favorable than before, i.e., borrowers can raise funds at a lower rate of interest and businesses will receive a higher price for securities of a given dividend-bearing power. Hence, the conditions leading to a bidding up of the value of existing securities are also likely to induce an increase in borrowing and an influx of new securities into the investment market with a corresponding increase in the use of real resources for the creation of real capital. In a similar way, the demand for land leading to the bidding up of existing land values may also induce the extension of cultivatable land areas through the draining and filling in of swamps and the irrigation of arid soils, and the willingness to invest in land acquisition at a sub-marginal rate of return may lead to the cultivation of submarginal lands. In both the instance of changes in the values of existing securities or in the values of an existing quantity of cultivated land, the effect on the formation of real capital is neither direct nor indirect but rather is concurrent, both the bidding up of the value of existing equities and the net formation of new capital proceeding in part from the same cause, but neither change requiring nor inducing a change of the other. However, it is not only that the effect on net capital formation is concurrent rather than causal which would permit us to disregard this qualifying consideration in our present analysis. More than this, while the concurrent effect on the formation of new capital may be strong and significant in the instance of a change in the market values of existing securities, this effect would be at most peripheral in the instance of the bidding up of land values in underdeveloped areas. In these communities, where surplus rural populations have sought land-outlets for many generations, it is likely that nothing short of a fundamental change in the agricultural technique and/or the social organization of the community in question would be needed in order to induce a significant extension in the area of cultivation. Hence we may assume a substantially fixed quantity of land, not significantly affected by the bidding up of land values.

What is essential is simply this; that the accumulation of land-wealth implies the bidding up of the value of an existing stock without requiring that the factors of production be channeled into the creation of real capital or into any use whatsoever. There would be signalled only an increase in the value of the claims (and hence in the "wealth") of the possessing classes, a wealth, however, that could never be realized in the total sense, since an attempt to achieve a net liquidation of the value of these claims in favor of commodities would lead to the automatic deterioration of the value of the claims. Given the institutionalized nature of the demand for land-ownership in these communities, proceeding as it does from traditional values and a fixed way of life, it is not likely that the net liquidation of land-equities would be attempted, except under such exceptional circumstances as when landowners face an imminent threat of national land reform, and hence land ownership in backward areas might be expected to provide

an exceptionally stable form of holding.[2] Moreover, the special values imputed to the ownership of land, including long-range security, political power, and social prestige, may induce the bidding up of land values out of all proportion to the capitalized yields there from, i.e., the market value of the land is consistently greater than the value of the agricultural yield capitalized at the current rate of interest.

But if it is true that the accumulation of wealth in the form of land ownership signals no increase in the net formation of real capital whatsoever, it must also be understood that the accumulation of wealth in this form does not divert resources from the accumulation of real capital. Unlike another favorite (and truly pernicious) form of wealth accumulation in backward areas—the hoarding of gold, silver, and other precious materials—the bidding up of land values creates wealth *without* preempting the use of domestic factors of production or foreign exchange so that these could not be used in the net formation of the real capital available for the use of these communities.

Each economy has a particular potential for net capital formation. This consists of all of the domestic factors and resources, whether employed or unemployed so long as they are available for production, plus the foreign resources and factors over which the particular economy, through grants-in-aid received or available, credits received or available, foreign exchange held, or by any other means can exercise an effective claim, and minus the domestic resources and factors required for subsistence and maintenance. There are many reasons why this potential for real capital formation may not be and has not been fully or properly used in the so-called underdeveloped areas of the world. Our concern at this point is only with the *potential* for net capital formation. Thus an increase in the local production or foreign import of precious metals for hoarding, or an increase in consumption would preempt resources and factors and hence would reduce the potential available for net capital formation. But the flow of investment into or out of land ownership, and the consequent rise or fall in land values, neither adds to nor reduces this potential for the accumulation of real capital. The potential *per se* remains unaffected by the level of land values. The bidding up of land values and the consequent creation of wealth in the form of higher-valued land involves no more than a series of transfer payments and a shifting of equities back and forth between members of the possessing classes. It adds nothing to real capital accumulation, but on the other hand it does not take anything away from the power to accumulate real capital either. The bidding up of land values does not decrease a community's financial capacity to invest in other areas than the land market, it merely shifts the power to make such investment between different members of the community. Nor, as we have seen, does it reduce the particular community's real capacity, measured by its command over foreign and domestic resources, to accumulate real capital. Hence we must conclude that the land hunger of the possessing classes in backward economies, leading to the bidding up of land values, is a neutral phenomenon insofar as the capacity of those communities for real capital accumulation is concerned; and therefore that the

[2] This indicates another important difference between accumulation in the form of land ownership as it occurs in underdeveloped areas of the world, and the analogous accumulation in the form of securities in the industrially advanced communities of the world; namely, that land ownership provides a relatively more stable form of wealth. This follows from the degree to which speculative purpose pervades the two types of investment, and from the degree to which alternatives to the one type of investment or the other are easily available and are psychologically acceptable to the possessing classes of underdeveloped economies in one instance, and of advanced industrial communities in the other. In the securities markets of advanced economies the price of shares is bid up in the expectation of increases in dividend rates, or in the hope of gaining through a resale at higher prices, and in either case the course of events is likely to bring a change of expectations and hence lead to a desire to liquidate ownership, either as a shift to the possession of some other security, or some other sort of investment, or in favor of a higher level of consumption. This shifting in and out of the market is facilitated by the highly developed form of market organization, which permits the quick, low-cost liquidation of ownership, and by a relatively higher degree of flexibility in consumption propensities, and by the existence of familiar and convenient alternative outlets for investment; all of which makes for a greater instability in the value of security holdings. Land purchases in underdeveloped communities, on the other hand, rather than reflecting a speculative intent are the manifestation of traditional values and a way of life satisfying the steadier drives for prestige, power and security. Moreover, the process of liquidation of land-wealth is relatively difficult and costly, and convenient alternative outlets for investment have either yet to be created, or are ignored by reason of the traditional inhibitions and propensities of the possessing classes in those communities. All of this tends to stabilize the value of land, and hence reenforces the traditional preference for wealth in the form of land ownership in backward areas as the means of providing the ultimate in long-range security for the possessing family unit.

argument to the effect that the accumulation of wealth in the form of land ownership is an alternative to (and represents a direct diversion from) the net formation of real capital appears to be a mistaken one. It does not follow however that because this argument is in error, that the conclusions for social policy that have been drawn from it are also false. We have considered here only the *potential* or the *capacity* of the community for net formation of real capital. However the phenomenon of wealth-accumulation in the form of land ownership has also direct and important effects on the realization of the potential for capital accumulation in underdeveloped economies, and these must now be taken into account.

Although the accumulation of wealth in the form of land ownership in backward areas is of itself neutral relative to the capacity of the community to create additions of real capital, there nevertheless appears to be indirect effects of the phenomenon on the form of economic organization, on the entrepreneurial and investor psychology, and on the level of consumption by the possessing classes in those communities which mitigate against capital formation and economic advance, and hence which vindicate the conclusions if not the rationale of those who have contended against the practice of wealth accumulation in the form of land ownership.

This form of wealth-accumulation affects the form of the economic organization in that it tends to perpetuate an unfortunate system of farm tenancy and absentee ownership of the land, bringing to the support of that system not only the property interest of the landlord but the weight of the political and social hierarchy as well since the stratification of power and prestige are linked to the ownership of land. In bidding up the value of land, this form of wealth accumulation increases the difficulty of the tenant-operator in ever acquiring the land which he cultivates. Thus the man who tills the soil, deprived of the prerogatives or hope of ownership, remains indifferent to the deterioration of a land that is not his or to the acquisition of new agricultural techniques the fruit of which would not fall to his portion. The consequent rootlessness and indignity of their circumstances has evidently helped to create a mood of political desperation and made the Asian peasantry vulnerable to the influence of revolutionary doctrine. Moreover, this form of wealth accumulation creates a type of absentee landlordism where the owner is neither knowledgeable regarding agricultural operations generally, nor interested in the specific practices of his cultivators. The ownership of land, for him, is the possession of a symbol and a realizable claim—but not of a business. The functions of entrepreneurship and management are delegated or left in abeyance. Consequently, the possibilities of efficient estate management, of the introduction of new methods of organization and new techniques, and the inauguration of experiment designed to develop techniques and methods of organization specifically suited to the special needs of the particular area, are all held to a minimum.

Moreover, the continuing pressure to accumulate land wealth has the effect of inflating the imputed (and in the aggregate, quite unrealizable) values of existing claims. This process of inflation of land values is not checked because it is not challenged inasmuch as there is no net attempt to realize on total claims. Because of the rising value of the claims in its possession, the possessing class *feels* that it owns more and regards itself as more secure, and hence is inclined to consume its current income to the full. It is not the increase in land values but the increase in consumption induced by the increase in land values which is the alternative to (and which creates the diversion from) the accumulation of real capital. Wealth accumulation in the form of land ownership does not divert resources, but it induces the diversion of resources into current consumption to a degree which might not have taken place if greater personal security could have been achieved only through types of investment requiring the accumulation of real capital, and a consequent increase in the production potentialities of the community.

The steady inflation of land values satisfies the need and yearning of the possessing classes for personal security without requiring a counterpoise for that increased security in the growth of real capital. If the need for security (or prestige and power) could not be sated through the possession of land because, for example, the land had been nationalized or measures had been taken effectively to limit the concentration of land ownership or to eliminate absentee landlordism, then it is possible that the wealthy would be driven to

seek out or to create new investment outlets requiring the net formation of real capital and the consequent industrialization of these communities. The possessing classes of these communities would be obliged to undertake the role of creative entrepreneurship in order to maintain security and status.

For these reasons the critics of the investment pattern characteristic of underdeveloped countries are right in opposing the institution of wealth-accumulation through land-ownership in those economies, though their correct conclusions may have been based on mistaken premises. In this paper we have tried to make explicit the effects of this type of wealth-accumulation, and we have suggested the lines of criticism that can properly be leveled against it.

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Book Reviews

The House and The Art of its Design. By Robert Woods Kennedy. New York: Reinhold Publishing Corporation, 1953. pp. 550, $9.

Robert Woods Kennedy's book, *The House and The Art of its Design*, has all the earmarks of a contemporary classic, including enough minor blemishes to bolster the ego of unsympathetic critics.

The book deals with the problems of housing design facing the creative architect today. The thesis is that innovation in housing is possible largely when designing for a small section of the upper middle class. Although Kennedy leans primarily upon personal experience and intuition, he finds outside support for these views. In Irving Rosow's sociological studies, for example, different types of families are distinguished by their "characteristic differences of Weltanschauung, goal orientation and aspirations, self conceptions, spheres of interest and activity, occupational status, use of leisure time . . . . type of family organization and relationships." The group living in modern houses, Rosow claims, "shows significantly less awareness of social conformity or assertion goals and thinks more in terms of personal needs and wants." On the other hand, the lower income groups are too poor and tradition-ridden to build or to experiment with new ways of living. And the upper classes, including most of the upper middle classes, are too driven by status drives to build or to buy other than traditional homes.

If this schema is correct, only the small innovating group of the upper middle class may be regarded as the natural ally of the architect. That is Kennedy's view and so the requirements of these families become his strategic starting point. He dissects their activities and characteristic behavior and explores the implications for the organization of space. He shows how the clients and the architects join forces to translate these requirements into a three dimensional solution, the way these decisions are made, the feasible choices considering the limited income, prevailing class values, and the unarticulated and frequently inconsistent family preferences. These discussions constitute the substance of the book and make most absorbing reading.

Kennedy takes "a dim view of modernism and traditionalism," the two rival approaches dominating architecture today. His sympathies are broader, almost eclectic. He realizes how much uncertain social status has been fortified by traditionalism and how much of a release of energy and intellectual renaissance was sparked by "modernism." But his ultimate test is simple and severe. Is the house gracious and efficient? Does it employ the best available techniques and materials? Is environment, site, structure and internal plan linked in one comprehensive solution to the functional and emotional requirements of the clients undistorted by Procrustean theories, superficial values or self-defeating practicality? If it satisfies these requirements it is a good house and Kennedy doesn't care how it will be pigeonholed.

Mr. Kennedy often makes his points by stress and sacrifice. There are decided advantages in this method. One cannot discuss everything. Nonetheless some of the omissions are disappointing, even though they are easily justified by the thesis. For example, almost nothing is said about the problems of design for lower- and middle-income groups. If there are any potentials in public and cooperative housing they are ignored; and if there aren't this is certainly what Kennedy would call "a strong statement" and requires far more justification. Prefabrication, too, is disregarded. Nor is there any discussion of other influences on house design besides the client, builder and architect. Surely among the increasingly significant forces today for good or evil are the effects on design of government controls, policies and subsidies. FHA is only one of the more obvious examples. These issues may be skirted by assuming that they affect in the main different income groups. Even if so, are we to infer that the architect cannot be an innovator

in this vast new domain where his influence may be so decisive and far reaching?

Almost every page is enlivened by Kennedy's crisp views and some of them are sure to provoke scepticism if not dissent. Many readers will certainly balk at his insistence on the phallic significance of the chimney or his tendency almost to cartoon some aspects of the modernist views which Mr. Kennedy does not like. Also from time to time the lively flow of ideas is annoyingly and unnecessarily interrupted by lists of things, activities and categories which the architect (not the reader) ought to ponder.

Like most volumes on architecture which are lavishly illustrated, the book is unfortunately expensive. It could have been cut with good effect on the weight, reading time and price. However, this is really a petty limitation. The writing is wonderfully lucid and witty, and the book itself, including the typography and layout, and the use of photographs, cartoons, comic strips, drawings, plans, diagrams and charts, is designed with impressive skill and imagination.

Unfortunately, comment on the central thesis, however accurate, hardly suggests the content, range or spirit of the study. Far more important than the justification of what Mr. Kennedy chose to discuss or even some of his intuitive social and psychological explanations, is the acuteness of the analysis of the problems that came within his professional line of vision. What is most fascinating about this book is the originality and verve with which the specific parts of the house are related and explored. Sites, entrances, living rooms, kitchens, bedrooms, toilets, lights, closets, fireplaces, relatives, friends, parties, moods—these, and a host of other familiar things and relationships, assume new meanings and possibilities. Though the book will delight and incite both laymen and architects, it should prove even more rewarding to economists and other social scientists. For far from being another account of how to build a house or a brief in favor of some particular school of thought, we have here a rare exposition of the sensitive designer's way of thinking about specific housing design problems and his perceptions about patterns of family behavior. To appreciate this the book itself must be tackled. For the many brilliant insights and effects, as in any creative work of art, simply elude summary.

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The Economics of Location. By August Losch. English translation by W. H. Woglom. New Haven, Connecticut: Yale University Press, 1954, pp. 508, $7.50.

The Economics of Location, first published in Germany during World War II as *Die raumliche Ordnung der Wirtschaft*, is the best general work on the economics of location, and the translator has performed a valuable service in making it generally available to English-speaking scholars. The selection of the title for the English version may have been unfortunate, for in present day parlance we are inclined to associate "location" with industrial location, but this treatise is concerned with industrial location only insofar as it is part of a much broader picture—spatial economics. Historically, economic theory has been temporally oriented; that is, the concern has been with adjustment through time. Losch, however, presents a discussion of spatial economics and adjustments through space and, in addition to industrial location, he discusses city and regional planning, international trade, price changes through space and other related topics. All are discussed from the standpoint of space as contrasted to time.

The author has some cogent remarks on the problem of industrial location. It is effectively demonstrated that decisions as to location are as much a part of the attempt to maximize profits as are the decisions regarding price and output. Price and location are inextricably interrelated for the "best" location is best for a certain price, and a change in price will mean a change in the ideal location. The author discards the approaches to industrial location which are based on either minimization of costs or maximization of revenue, but he maintains that the proper premise is one of profit maximization.

Location theory is often criticized because of its lack of realism for there are a large number of industrial locations which are not economically sound. Losch explains this by distinguishing between the corporation and

the individual entrepreneur. The former will locate a plant so as to maximize profits, but the individual, rather than being guided solely by profits, is interested in maximizing his utility. Furthermore, location theory is not intended to explain the actual location of industry but only where it should be located. It is interesting to note that, whereas the corporation has introduced certain complexities into profit theory, it has made location theory somewhat more realistic since the corporation resembles the "economic man" in regard to plant location.

Economics of Location will be valuable for American scholars as the author makes extensive use of statistics for this country. It will be stimulating to those in such diverse fields as econometrics, methodology, marketing, city and regional planning, price theory, international trade, economic geography, political science, and model building. As the author says, he is attempting to provide a "new formulation of the entire theory of economics."

JOHN M. KUHLMAN
University of Richmond

Planning Residential Subdivisions. By V. Joseph Kostka. Winnipeg, Manitoba, Canada: Hignell Printing Company, 1954, pp. 127. (Sponsored by The Appraisal Institute of Canada.)

Mr. Kostka's book sets forth in a well organized manner and easily readable form various desirable objectives to be aimed for by any developer of land for residential use. He also states in considerable detail the various techniques that can be used in order to achieve such objectives. Many excellent reasons are presented for planning and developing each area of land for its intended use rather than forcing it to conform to a preconceived pattern.

The various factors which should be considered when selecting a site are set forth in such a way that they should be a great help to any developer and his technicians. The matters that should be determined by each technician are delineated and there are many logical arguments in favor of complete and detailed planning before construction is commenced.

However, many of the ways for securing these desirable objectives may be difficult for the average speculative mass production builder to follow; in many cases, builders have not yet realized the advantages of giving full consideration to esthetic factors in developing land. We may hope that these will become increasingly important as our market becomes more competitive. At that time this book will serve a noble purpose.

Although the text is generally excellent, the various plans and sketches used as examples are disappointing. Some of the very unusual street patterns may be due to topographical conditions, but there is nothing to indicate it. Some of these plans appear to have excessive amounts of poorly designed streets. In a number of cases it would be very difficult to place houses in the best possible relation to each other.

The various design and engineering standards for grading, drainage and utility installation are ideal, but may be difficult to achieve on this side of the border. However, they do represent our best thinking at this time.

There are many sections that might be quoted in this review. However, since continuing efforts are being made by our planning technicians to secure such objectives, it is to be hoped that Mr. Kostka's book will have wide circulation among local officials and developers, for it is a welcome addition to the rapidly expanding library on this subject.

EDWARD FLICKINGER
Federal Housing Administration, Chicago, Illinois

Urban Traffic. By Robert B. Mitchell and Chester Rapkin. New York City: Columbia University Press, 1954. $5.00.

In recent years there has been an ever-increasing interest in the rebuilding of the central areas of our cities. Immense new traffic facilities are often a by-product of these redevelopment programs. The cost of such undertakings has led to inquiry on the part of thoughtful persons as to the efficiency of the research on which we base these bold new plans.

Urban Traffic is an attempt to develop a means of measuring the traffic-generating capacities of central area land uses. The

authors approach the problem in a strictly scientific manner. Theoretic concepts are tested with limited field data and these data are found to be generally consistent with the theories. One of the most useful ideas one might get from reading this book is that certain traffic-generating factors for both automobile and truck traffic might conceivably unfold themselves for various land uses if this type of research is continued. While the validity of such factors might readily be questioned by an expert, their effectiveness when used on laymen who tend to overly respect the scientific approach to difficult problems is admitted.

Planners might wonder whether this scientific approach is essential in long-range planning. While detailed factual data may be needed to formulate detailed engineering plans for the city of today, one might wonder whether wisdom is not a more important ingredient in the outlining of plans for the city of the future. And is not the latter, after all, the primary responsibility of the planner? To read this book one must wade through a great many lengthy definitions of terms, most of which are repeated in the glossary. It almost seems, at some points, that the elaborate explanations and cumbersome language were measured to fill the space between the book's two covers. *Urban Traffic* can at most be considered a progress report on what will be a huge study if it is adequate. Perhaps the book's saving grace is that it purports to be little more than that.

WALTER K. JOHNSON
Planning Director,
City of Madison, Wisconsin

Ocean Transportation. By Carl E. McDowell and Helen M. Gibbs. New York: McGraw-Hill Book Company, Inc., 1954. pp. xv, 475. $7.00.

For a number of years there has been need for a new or revised text for college classes in the field of water transportation. As a text *Ocean Transportation* will disappoint those who may have hoped that it would be a complete answer to that need. It suffers from the fact that it has been written by nine persons—seven chapters by C. E. McDowell, seven by H. M. Gibbs, two by H. S. Haehl, Jr., and one each by J. H. Frederick, F. J. Zito, A. B. Poole, W. G. Hays, R. F. Burley, and J. M. Sullivan. The result is a considerable amount of unevenness and lack of cohesion which detracts from the volume's usefulness as a text. On the other hand, when used as a handbook on the several subjects covered, the disadvantages are less apparent. Each chapter and subject tends to stand alone and be fairly complete. The writing style, as a whole, is readable, and the maps, drawings, tables, and index are adequate. The volume is divided into twenty-two chapters and five parts. The parts are entitled, "Shipping in the World Economy," "The Shipping Process," "The Finance of Shipping," "Admiralty, Insurance, and Regulation," and "The Role of Government."

The book contains incomplete bibliographical material which also detracts from its usefulness as a text. While several of the chapters have adequate bibliographies, six have no bibliographies, and one looks in vain for reference to some of the previous writers in the field who deserve at least an historical mention. Among those missing are the late E. R. Johnson, G. L. Wilson, G. G. Huebner, A. K. Henry, R. S. MacElwee, A. Berglund, R. Riegel, and others.

The authors "concentrate on the ship and on ship operation and management primarily from the view of the ship operation." Such activities as admiralty law, marine insurance, and freight rates are "discussed primarily as they affect the shipowner rather than as they affect other interests such as the shipper, the consignee, or the public in general." Such emphasis tends to slight the public problems of ocean shipping. Many issues of public policy are passed over with cursory treatment. Among these are the problems of the shipping conference and the economics of ocean shipping in the international balance of payments. A more comprehensive discussion of these and similar problems would have improved this volume considerably.

LESLIE A. BRYAN
University of Illinois

Elements of Pure Economics. By Leon Walras, English translation by William Jaffe: Homewood, Illinois: Richard D. Irwin, 1954, pp. 620, $7.50.

Schumpeter and many others have called Leon Walras the greatest economic theorist

of all time. Yet his masterpiece is only now available in English, 80 years after its first edition. In compensation for the long wait, Professor Jaffe gives us after a quarter-century of labor not only a translation, but also a variorum edition and copious notes in which obscurities in Walras are clarified, erroneous impressions of Walras are criticized, and subsequent developments are summarized. The result is comparable to Cannan's Smith and Ashley's Mill: need we say more?

Yet even this superlative translation will not rescue Walras from the ranks of classics cited but unread. This is not the translator's fault, but the author's. (Despite occasional pitfalls for the unwary foreign reader, Walras' French is for the most part so simple that one can hardly believe the language important in explaining his neglect in English-speaking countries.) Walras was in fact a Frenchman who wrote like a German, a mystical German who preached from ten till four, although he himself knew little German. He was redundant. His sense of proportion was deficient. He bore on each shoulder a pagoda of chips, scattered through his pages in pedantic methodological diatribes against the forgotten worthies who forced him from his native land to find employment. He was an apostle of the mathematical method, but unfortunately his own mathematics was little better than his prose. He uses analytic geometry and calculus with the main force and awkwardness of a schoolboy multiplying by addition. (Pareto was far better, especially in his *Cours d'Economie Politique* of 1896-97, which if translated, would make better "Lausanne School" propaganda than does the work under review.)

Most English-speaking readers derive their knowledge of general-equilibrium or "Lausanne School" economics at second hand, often from Gustav Cassel's *Theory of Social Economy*. It may therefore be worth listing some of the respects in which Walras differs (usually for the better) from his Swedish follower. First and foremost, Walras had what Schumpeter called a "vision" of general equilibrium, while Cassel was in this respect a textbook-writer or transmission belt. (Transmission belts are seldom noted for vision.) On more technical matters: Walras derived demand and supply conditions from considerations of utility and cost, and considers their welfare implications, while Cassel simply took these conditions as given. Walras worked wearisomely up to market situations from isolated exchanges, while Cassel started directly with the market. Walras applies his general-equilibrium analysis to interest and money along with exchange and production, deriving finally an equilibrium which required an equation of exchange for the transformation to absolute prices. (As Patinkin has pointed out, there is no logical basis for an equation of exchange in Cassel's system: his demand and supply functions are homogeneous of degree zero in prices and incomes, meaning that the price level is irrevelant to economic activity.) Finally, Walras applies his general-equilibrium analysis directly to problems of his day (most notably, the bimetallist controversy), whereas the famous empirical and statistical passages in Cassel's applied economics are quite divorced from his general-equilibrium model.

Humor has been wasted on Walrasian economics as a barren process of "counting equations and unknowns." This counting procedure is nothing more than a check on the logical consistency of the underlying theory. No good theory should fail to satisfy it, but many a bad one may pass muster and Walras' own was far from perfect. But general-equilibrium economics did not die with Walras. Later writers in the Lausanne tradition, no longer satisfied with logical consistency, tried to render general-equilibrium systems amenable to empirical verification by supplementary developments permitting forecasts of directions of change. (The names of Hicks and Samuelson come to mind here.) Others, beginning with Pareto, have striven for greater generality than Walras himself, by making such variables as production coefficients and cash balances unknown, rather than taking them as given. Others have made extensions to international trade (Mosak), imperfect competition (Triffin), etc. Walras does not provide enough equipment to tackle Samuelson's *Foundations* or the appendices to Hicks' *Value and Capital*, but there is that in him which defies mere technical obsolescence. For that reason alone, it is good to see his *Elements* move out of the rare book room to the library shelves; the profession's thanks are due to Professor Jaffe for making the move possible.

M. Bronfenbrenner

University of Wisconsin

When the Cathedrals Were White. A Journey to the Country of Timid People. By Le Corbusier. New York: Reynal & Hitchcock, 1947, pp. 217. (English Translation by Francis E. Hyslop, Jr.)

On the morning after Le Corbusier arrived in New York in the middle thirties, *The New York Herald Tribune* printed in big type over a caricature of him:

"FINDS AMERICAN SKYSCRAPERS MUCH TOO SMALL,

Skyscrapers Not Big Enough,

Says Le Corbusier at First Sight,

Thinks They Should Be Huge and a Lot Further Apart."

When the Cathedrals Were White is an elaboration of the Le Carbusier point of view. Published in part in *Direction* in 1938 and 1939, it was not brought out in book form until after the war. A generation has now elapsed since it was written; despite certain marks of the depression years, this book speaks more powerfully today than when it was written—just as today we are closer to stark reality than we were then. We now know it is later than we thought.

The central thesis is easily stated: (1) We are living in a new time—called by some "the machine age." We must adopt new patterns suitable to the new times. A new way of living, a new vigor, a new spirit must emerge. (2) Seven hundred years ago a parallel ("contemporary" in a sense) epoch occurred, which was symbolized by the building of cathedrals. (3) But while the cathedrals-builder boldly carved history to their liking, the skyscraper builders of today are timid. On the one hand there is drama, intensity, vigor in our great cities; on the other, fear of the unknown.

To Le Corbusier, the only rational answer to the problems of our cities—to urban deterioration, traffic congestion, sprawling cities, wasteful transportation, and low living standards—is a bold one: Convert cities into locii of towering business and residential buildings. As an example, he cites Manhattan which, "has value only along its spinal column; the borders are slums. On foot you can walk across town in twenty minutes and see that spectacle of contrasts. But what satisfaction can rationality find in it? . . . . The sea and the vast rivers are invisible and no one gets the benefit of their beauty, their spaciousness, their movement, the splendid play of light on the water! . . . . Manhattan is a city so hostile to the most fundamental needs of the human spirit that the dream of escape fixes itself in every heart. Get away! Avoid dissipating your life, the life of your family, in the midst of this implacable hardness."

Next comes, as Le Corbusier says and we have all seen, the trek to the suburbs. Result? For his few trees and a road in front of his house, the suburbanite sacrifices hours of transit time. And society, in Le Corbusier's view, loses "all collective life—the sap of a nation." He has no kind words for the garden city.

Instead, he would like to rebuild Manhattan. By building high, he says, it is possible to house 400 persons per acre in excellent living conditions. Since that island has an area of about 16,000 acres it could house more than 6,000,000 persons. Le Corbusier's description of this new "radiant" Manhattan: "Twelve percent of the ground for buildings; 88 percent for parks, promenades and sport; separation of pedestrians and cars; sport just outside the door; great spaces outside each window; and windows that *all* get the sun."

France, Le Corbusier foresaw in the thirties, would not be a leader in establishing the new urban pattern. America is the lusty young giant that could if it only had the courage. "We French, who have had the cathedrals and Louis XIV, can admire the prodigious work which is still in the progress of birth, accomplished by the people of America," he says in the introduction (1947). He concludes this introduction by saying that city planning is "a key, the key," but that it is still in doubt whether "the men of the second period of machine civilization, after having acted like gangsters and madmen, will set their house in order again."

The City has been a central problem in the decline of every previous civilization. In none has the problem been solved. What would it not mean for the destiny of the West if Western man proved himself master of his cities?

STEPHEN B. MILES, JR.

Burbank, California

Japanese Food Management in World War II. By Bruce F. Johnson. Stanford, California: Food Research Institute, 1953. pp. 237, $7.50.

"Too many people on too little land" has long characterized Japan's agrarian problem. The authors feature this statement in introducing the wealth of detail presented in their study. The book is brought out by the Food Research Institute of Stanford University. The senior author had associated with him as co-authors two well-informed Japanese, Messrs. Hosoda and Kusumi.

By the early 1930's, as reported by the authors, the Japanese Empire had to all practical purposes achieved its goal of self-sufficiency in food supply. A considerable amount of this food was brought in from the colonies. A wide range of food was produced, especially sugar and tropical products in Formosa, rice in Korea, and soy beans and winter cereals in Manchukuo.

Japan's food supply was heavily weighted on the cereal side, with relatively small intakes of supplementary foods except vegetables. As compared with the United States, where cereals made up less than a third of the average 3100 calories, the Japanese were depending on cereals to furnish 1600 of their 2250 calories. Animal protein was very low, and fish consumption relatively large. There were deficiencies of thiamin, and beri-beri was common. Pellagra was rare, as was also scurvy. Tuberculosis was prevalent, Japan being third highest among 47 countries. The per capita intake of calcium was low.

Food production remained much the same during the first years of World War II. But as time passed, the imports of food products from the colonies declined, and towards the end of the war there was a marked decrease in availability of commercial fertilizers, in livestock, and in other factors related to home production. Even so, with added emphasis on green manures, home yields were kept from dropping sharply. The government put real pressure upon farmers to produce as much staple food as possible. Towards the end of the war, the fish catch, too, had dropped to less than half, resulting in serious protein shortage. Food rationing was very strict; with a near absence of refrigerated cars, vegetables, fish products, and other perishable foods often reached the consumer in bad shape.

The food shortage immediately after the war was supplemented by imports of foods, largely from America, in amounts about equal to what the four home islands had imported from the colonies before the war.

The authors have presented a wealth of detail which will be of value to students of Japanese conditions prior to, during and immediately after the war, particularly as related to food production and consumption. The book is valuable, too, as a record of food as a factor in the development of the Japanese Empire, and of adjustments which had to be made when the colonies were lost and the Japanese abroad were repatriated to the four home islands.

ARTHUR F. RAPER

Foreign Operations Administration, Washington, D. C.

Great Cities of the World, Their Government, Politics and Planning. Edited by William A. Robson. London: George Allen and Unwin Ltd., 1954. Pp. 693, 74 illustrations, 9 maps and diagrams. 63 shillings. (New York: The MacMillan, $10.00).

This pioneer volume has been five years in the making. It was a gleam in the editor's eye nearly twenty years ago when he was writing of London and Moscow and felt the lack of a book dealing specifically with metropolitan cities. A life-time student of municipal government, Professor Robson rightly thinks that the government of metropolises presents problems different in kind, not merely in size, from that of lesser cities. Prime differences are the remoteness of giant municipal government from its citizens and the universal failure of the boundaries of the central unit to encompass the living community.

Professor Robson has here assembled eighteen monographic essays, each from twenty-five to thirty-five pages, by twenty hands on twenty cities of Asia (Bombay and Calcutta), the Antipodes (Wellington, Sydney), Latin America (Buenos Aires, Rio de Janeiro), Scandinavia (Copenhagen, Stockholm), the United Kingdom (London, Manchester), Western Europe (Amsterdam, Paris, Rome, Zurich), USSR (Moscow), North

America (Chicago, Los Angeles, Montreal and Toronto, New York). The editor fends off criticism of the representativeness of his sample by assurances that he solicited chapters on other important cities for which he has only broken promises to show. He set himself the standard of authors who had lived in a city or studied it on the spot and who would not provide dry accounts of structure and legal powers. This standard has been met.

Professor Robson has been more than editor. He has contributed the chapter on London, which he is uniquely qualified to write. In his role as political scientist, he introduces the eighteen monographs by an eighty-page synoptic essay in which he offers definition, classification, comparison, and generalization. As for definition, he is acutely unhappy over the new U. S. Census "standard metropolitan area" because it disregards the functions of a "metropolitan area worthy of its name," to wit, to serve as a great center of politics, government, commerce, industry or culture, or a combination of these.

He summarizes metropolitan problems under five heads. Under "organization of areas and authorities" he notes the universal fragmentation of metropolitan government. Under "popular interest and democratic participation," he proposes "a two-tier structure" of government as the right principle to bring the citizen closer to his councilman on local matters. Apparently only Moscow "has so far followed the example of London." The evidence under his third head, "efficiency of municipal services," suggests that "the great city of today lives by a miracle." Fourthly, "a chronic state of financial stringency appears to be a permanent condition" in which "wealthy New York City joins with impoverished Calcutta," however varied their sources of revenue. Robson notes that it is practically impossible to state total public expenditures in most metropolises: "it is not always easy to distinguish the central grants from the local taxes." Finally, "planning the great city" seems nowhere adequately organized to establish goals for rational living encompassing the whole metropolitan community, with proper powers of execution, except where the metropolis is dominated by the national government.

In sum, this most elaborate basis ever assembled for comparison reveals that no country has found the answers to the difficult metropolitan problems with which each is struggling. Yet U. S. readers will be cheered to read that "the 'home rule' cities of the U. S. A. . . . . enjoy an exceptionally high degree of freedom." The monographic essays, furthermore, invite comparisons not drawn explicity by the editor. For example, how is planning organized in the various cities? Almost nowhere is the concept recognized of planning as a tool of coordination. In the British cities there is a standing committee of the council on planning on the same plane as fifteen other standing committees.

The editor is served with varying effect by his contributors, so far as a less than global reviewer can judge. Lady Simon's sprightly account of Manchester is illumined by her long service on the city council. She evidences a more realistic sense of the meshing of "policy" and "administration" (p. 271) than the author of the essay on London. (p. 336) Robert A. Walker's report on Chicago demonstrates that a first-rate account may be written after long absence from the city; he is buttressed, as he proclaims, by a mass of supporting local research probably unequalled anywhere else. Unfortunately, Rexford Tugwell has been too long away from New York, where his experiences were none too happy. In the perspective of his receding memory, the island of Manhattan has shrunk to half its physical size (p. 414), the population of Brooklyn has increased by a third. (p. 431) Even "the best mayors" seem to him dominated by "a mere perverse determination not to allow the planning process to grow in prestige." (p. 426) The editor may not be expected to know that this statement reflects Tugwell's theory of the primacy of the planning power, expressed in Puerto Rico in 1953 as in Washington in 1939. The editor's generalizations are weakened by reliance upon Tugwell's misstatement of the duties of the new City Administrator, and his assertion of the city's "chronic bankruptcy," without explaining (as Walker does for Chicago) that it is the result, in great part, of state legislative limitations.

Whatever failures and inadequacies they recount, the editor and his contributors commemorate the metropolitan way of life with pride and hope. This pioneer volume affords fresh insights and understandings—an important step toward ultimate solutions.

Brooklyn College CHARLES S. ASCHER

Parking as a Factor in Business. Containing Five Papers Presented at the Thirty-Second Annual Meeting, January 13, 16, 1953, Special Report II. Washington, D. C.: Highway Research Board, pp. 294, 1954, $6.00.

One of the most promising developments in the field of urban transportation is the growing recognition among highway engineers that volume and pattern of traffic and parking is a function of the use of land and not a phenomenon that is isolated between curb lines. A significant result of this recognition is this study on parking and business which presents the first extended research on the subject. The Automotive Safety Foundation should be congratulated for making the necessary funds available for these studies.

The Special Report II brings together five independent studies conducted more or less concurrently at four universities. The studies cover attitudes, economic relationships, property values and trends in transportation in the metropolitan areas of Columbus, Ohio; Seattle; Detroit; San Francisco; and Oakland; with questionnaire and interview surveys of selected Michigan cities and elsewhere. A lengthy foreword acts as a summary of the major findings.

Briefly, the findings show a continued increase and dominance of central business districts, especially in the shopping goods lines, in spite of losses in convenience goods and downtown parking spaces in the most desirable locations and at the curb. New parking facilities in fringe locations were found to cater to the all-day parker, while public transit patronage continues to drop. Although parking space becomes an increasingly attractive feature, department stores have established their branches in rapidly growing residential areas to hold or regain lost customers and, more importantly, to tap the new increment.

In spite of these adverse trends relative to the central city, the findings of all studies appear to support the conclusion that it is destined to remain the dominant business area, and may even benefit by the suburban trend through greater accessibility and a better allocation of inter-related financial, business and civic uses.

The significance of this research is not so much that it has brought forth any new or startling findings and conclusions but that it has helped to confirm and measure more accurately the considered judgment of those who have faith in the central city's future and have not been carried away by the dire prophecies of the "dispersionist".

One of the most significant findings is the fact that off-street parking may not be quite the all-important factor that many have visualized it to be.

While one could have wished these studies were more nearly comparable in scope and coverage of their subject, they have provided a testing ground for new methods of research analysis in this important field as well as furnishing valuable evidence on the virility of our central city areas.

MAX S. WEHRLY

Urban Land Institute, Washington, D. C.

Comparative Population and Urban Research Via Multiple Regression and Covariance Analysis. By Donald J. Bogue and Dorothy L. Harris. Oxford, Ohio: Scripps Foundation for Research in Population Problems, 1954. pp. vii, 75, $.90 paperbound.

This is another of the series of excellent monographs being produced by Donald Bogue at Miami University and the University of Chicago, using data from the United States Bureau of the Census. Although its contributions are largely methodological, there are interesting substantive findings. The subtitle accurately describes the book as "A Methodological Experiment, with an Illustrative Application to the Study of Factors in the Growth and Suburbanization of Metropolitan Population."

Bogue and Harris avoid two serious deficiencies in current urban and demographic research. First, this is a comparative study which attempts to discover general patterns (and deviations from them) among a number of cities. Second, the authors have devised a method of calculating the degree to which each variable can explain the phenomena under investigation. These objectives are accomplished through the use of two established statistical techniques: multiple regression and the analysis of covariance. By

adapting these tools to the study of urban population trends, the authors demonstrate how much additional understanding may result from a careful, sophisticated statistical analysis of existing data.

The subject matter is the 125 standard metropolitan areas of more than 100,000 population. Twenty-nine sociological and economic variables are used to account for variations in the rate of metropolitan growth, the rate of suburbanization, and the distribution pattern around the central city. Significant regional differences exist between the five economic provinces of the United States previously delimited by Bogue. Since the authors limit their attention to changes between 1940 and 1950, their generalizations are tentative. Replication of this work using 1960 Census data would be highly desirable.

This is an excellent piece of research, intended for a professional audience. The assumptions, operations, and conclusions are stated explicitly. Bogue and Harris are especially to be commended for their restraint in claiming only the supportable minimum of validity for their results.

The writing lacks literary charm, but it exposes unambiguously the skeleton of thought underlying the words. Chapter I contains a particularly clear statement of the meaning, use, and limitations of multiple variable regression analysis. Computational procedures are presented in detail in an appendix.

RALPH THOMLINSON
University of Wisconsin

Organized Industrial Districts, A Tool for Community Development. By Theodore K. Pasma. Washington, D. C.: Superintendent of Documents, Government Printing Office, 1954. 65 cents.

This study of Organized Industrial Districts is a highly significant contribution of the Area Development Division of the Department of Commerce. It is a thorough and scholarly job covering in considerable detail virtually every phase of the subject. It is in fact the most comprehensive report yet made of planned industrial districts. It is more than a "tool for community development"; it is a tool for *better* community development.

This "guidebook," as it is called, has nine chapters. The first chapter defines an "organized district" and notes that projects of this type fit nicely into good community planning. It further notes that from the functional standpoint industries also find a "district" location very desirable. It also describes in a general way the growth of organized districts across the nation, and in particular the rapid development of recent years. The next seven chapters outline, among other things, the need for careful study and planning before organizing a district; types of legal organization, including community and privately-owned projects; cost of development and manner of financing; methods of controlling expansion so as to maintain high standards; locating and purchasing a tract and conditioning it for industrial uses; services and facilities; and finally the promotional program needed to "sell" the district. The ninth and last chapter outlines the case histories of twelve successful districts.

The format of this report is excellent. It is easy to read; moreover, points of special interest can be located readily since numerous well-defined subheadings delineate major and minor topics. Almost thirty photographs, diagrams and maps illustrate significant points.

In preparing this guidebook Mr. Pasma visited all major organized districts in the United States, thus securing a great deal of first-hand information from men who have pioneered and who are leaders in this specialized and fast-growing field. Altogether facts were drawn from the experience of over one hundred industrial districts, all more or less planned developments. Good and poor practices were analyzed and carefully catalogued before drawing conclusions.

City planners, Chamber of Commerce executives, industrial realtors, indeed all persons interested in efficient and attractive industrial development should find this book an extremely helpful tool in attaining that desirable goal.

ROBERT L. WRIGLEY, JR.
Chief, Project Planning Branch, Maryland-National Capital Park and Planning Commission

The Nation Looks at Its Resources. Report of the Mid-Century Conference on Resources for the Future. Washington:

Resources for the Future, Inc., 1954. pp. 418. $5.00.

In December 1953 sixteen hundred persons gathered in Washington for a three-day discussion of the nation's long-range problems of natural resources. Financed by the Ford Foundation, this conference was the first major undertaking to be sponsored by Resources for the Future, Inc. Although the meeting was conceived essentially as a successor to the Roosevelt-Pinchot 1908 Conference of Governors, it seems to have attracted few if any active governors—a circumstance testifying perhaps to the wisdom of both the governors and the sponsors. The politician's trade nevertheless was represented abundantly by officials of special interest organizations in grand variety, and this category of participants was partially overlapped by large contingents of bureaucrats, professors of natural and social sciences, engineers and other experts, journalists, and interested laymen. Altogether, a big dipperful of the cream of our democratic community.

In his opening remarks, Lewis W. Douglas, chairman of the conference, said emphatically that its purpose was not to state any categorical conclusions or to prepare a program. "We meet rather in a collective attempt to define some of the issues." Two major conference aims indicated by R. G. Gustafson, president and executive director of the sponsoring organization, were to enlist wider interest in resource issues and to help bring about greater mutual understanding among the diverse groups who will largely determine decisions. These purposes undoubtedly were achieved in significant degree, even though at some points there was evident a considable reluctance to face or to define "the issues" explicitly. Two of the ablest participants in the water section were concerned on this score. One said, "we have skirted the very important question of the public interest" and suggested a consideration of the "fundamental question: wherein does the public interest lie?" Another observed, "Aside from a few individuals, there seemed to be a singular lack of disposition to take up the question of the public interest in relation to water resources." He believed the reason to be the peculiar difficulty of distinguishing among the interests involved.

The conference was organized in eight major sections, five of which were further divided into subsections, and the main body of the conference report follows that basic pattern. The major sections are: competing demands for the use of land; utilization and development of land resources; water resource problems; domestic problems of nonfuel minerals; energy resource problems; U. S. concern with world resources; problems in resources research; and patterns of cooperation. The report also contains summaries of a basic background paper, prepared by Wilfred Owen, and of two forum debates—one on control of public lands and the other concerning how much we should depend on foreign resources. In the appendix is an appropriate note by the editor explaining how the conference was organized and how the report was put together; and the list of registrants (grouped by conference sections), the index to speakers, and the guide to principal subjects are indispensable aids to finding one's way around in the big volume.

The bulk of the report, drawn from the 5000-page verbatim transcript, consists of exceedingly brief or thoroughly boiled-down passages from the original speeches and remarks of section and subsection participants. Such a town meeting digest has unavoidable shortcomings, but it also has real value as a sort of panoramic display of diverse viewpoints and ideas; and these materials are held together and rendered more nearly comprehensible by an introduction and a chairman's summary for each section.

President Gustafson saw three significant themes recurring frequently in all the section discussions: "(1) The need to enlarge our knowledge through research; (2) the need to disseminate new knowledge more widely through education; and (3) the need to apply knowledge more effectively through cooperation." The needs are not news, but the conference record will help to guide the foundation and others in future efforts to meet those needs. The record also indicates anew (often between the lines) some of the dogmatic ideas and narrow interests linked with contending political power blocs. Clearly, a great deal of relatively disinterested intelligence will have to be developed both outside and within those groups if our resources problems are to be met more effectively in the long-run interest of the country.

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Agricultural Development and Rural Reform in Denmark. By F. Skrubbeltrang. Rome, Italy: Food and Agriculture Organization, 1953. p. 320, $3.00.

"Economic development" became a policy motto for most of the colonial nations which only recently gained independence. And it is a desirable policy, no doubt. To carry it out is, however, somewhat more difficult. A good many countries became inflicted with the industrialization-at-any-price fad. Steel plants, dams—the bigger the better—that seemed to be true economic development. Agricultural reforms were apparently not so "prestige-producing."

This book shows clearly that a country can develop even if the endeavors are primarily directed towards agriculture. Mr. Skrubbeltrang takes us from the dark Middle Ages right to 1953. We are shown how the feudal land system changed into a society of free peasants, who were able to develop the institutions of voluntary cooperation to an intensity and effectiveness it never has encountered before.

It is only seldom realized, however, that even the medieval darkness contained a good many positive seeds. Denmark, and many other Central and North European countries, had a collective field cultivation system in each village (Landsby Faelleskab). The country was divided into large estates—manors. The peasants were tied to the manor, working a certain number of days on the landlord's demesne. The rest of the week could and should be spent in work on the individual holdings in the village (landsby) close to the estate. In the village an undisputed right of private ownership prevailed. The village land was distributed among the peasants in lots varying in size so as to assure an acreage of equal inherent fertility to each individual. The three-field crop rotation (trevangsbruget) was then prevalent. This meant that the three major fields (rye, barley and fallow) were broken up in as many individual plots as there were peasants in the village. The use of pasture on the commons (overdrev) on the outskirts of the community was also rationed by determining how many head of livestock each peasant could graze there.

There were few statutory provisions forcing the peasants to work their fields in a certain manner. The layout of the plots did, however, make it almost imperative to abandon individual cultivation. The individual strips wedged into other property, often without direct roads.

Out of economic necessity, it thus became imperative for the peasants to cooperate in working their land, which was owned, theoretically at least, with what would today be considered a limited fee simple. And so, willy-nilly, a well-organized community life developed as one of the good features of the Danish feudal system. It was run on a reasonably democratic basis, slowly developed.

Although the individual peasants were not legally bound to participate in this form of cooperation, social forces were extremely compelling. The traditional spirit of Faelleskab aided Denmark when she commercialized her agriculture in the latter part of the 19th century. The inherent natural tendencies towards mutual assistance constituted the backbone of what subsequently became one of the most successful networks of agricultural cooperatives in modern times. Experts from the entire world still flock to Denmark in the hope that they can gather inspiration to facilitate an establishment of a similar movement in their respective countries.

The Faelleskab is, of course, only one, and in the reviewer's opinion not sufficiently emphasized, of the many factors which co-determined the success of the agrarian reforms. Denmark was also blessed with great personalities which were able to apply the ideas of enlightenment and provide the leadership at the right time and in the right place. Partially the progress was brought about as a reaction to national catastrophies, such as the defeat by the Germans in 1864; in conformance with Mr. Toynbee's theories, the necessary stimuli for internal development. The leadership of Bishop Grundtwig, the founder of modern Danish education (the folk high schools) and cooperatives, was of crucial importance.

The case of Denmark is unique, of course. Yet many leaves from this experience can be taken by people who are in charge of the long-term planning in underdeveloped areas. The agricultural sector simply cannot be ignored in any comprehensive plan of economic development.

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The Demographic Yearbook 1954. United Nations. Available through the authorized sales agent for United Nations publications, including Columbia University Press, New York City, pp. 729, clothbound edition $7.50, paperbound $6.00.

According to this publication, the birth rate is declining from its post-World War II peak but is still above the 1939 level in most countries. The *Yearbook*, described as the most comprehensive compilation of demographic figures ever assembled and published by the UN Statistical office, provides birth statistics for 183 countries and territories for the period 1920-1953. In addition, it gives statistics on area, population, population density, mortality, marriage, divorce and migration.

Tables in the *Yearbook* indicate, among other things, that the long-term trend toward lower stillbirth ratios is continuing, that infant mortality is continuing to decrease and life expectancy to increase, and that the combination of these trends points toward larger populations in the future.

The *Yearbook* does not include current information for the USSR or all the countries of eastern Europe.

Birth Rates Decline Since Postwar Peak. Statistics in the *Yearbook* show that the rise in the birth rate that began with World War II and reached its peak in 1946-47 has been gradually declining since that time. Perhaps the most striking postwar change in the birth rate occurred in Japan, where the drop since 1947 has been from 34.3 births per 1,000 population to 21.5, a decrease of 37 percent.

However, 1952-53 rates are higher, in general, than the prewar level, the *Yearbook* shows. For example, the birth rate in France rose from 14.7 in 1939 to 23.8 in 1947 and then dropped to 18.7 in 1953. Similarly, the figures in the United States are: 17.3 in 1939, 25.8 at the postwar peak, and 24.7 in 1953; in England and Wales, 14.8 in 1939, 20.5 at the postwar peak, 15.4 in 1953; in Chile, 33.3 in 1939, 33.8 after the war, and 36.1 in 1953.

These general trends are confirmed in part by information on the age at which women are having children. The high birth rates at the younger ages appear to be leveling off in a number of countries, at the same time that birth rates at the older ages are decreasing. These changes are very small, however, and no worldwide pattern is discernible.

About 35 percent of the countries reporting show birth rates exceeding 34 per 1,000 population. (The rate in industrialized countries is generally under 25.) The average might be said to be about 30, although information is incomplete for Asia and Africa, where rates are generally conceded to be much higher. If the coverage could be extended to include accurate data for all the world, the incidence of rates above 35 would undoubtedly be increased, the Statistical Office believes.

An introductory section, "Technical Notes," calls attention to the lack of geographic coverage in vital statistics and to the deficiencies in information which is available. Births are regularly reported for only about one-third of the world's population. For another portion, there are fragmentary or irregular reports, many considered of dubious accuracy. For almost one-half the world's population, therefore, there is no accurate information upon which to evaluate potential growth.

Stillbirth Ratio Declining. A continued long-term trend toward lower stillbirth ratios (the number of stillbirths per 1,000 live births) is reported in tables of the Demographic Yearbook, which contains more information on this subject than has been assembled previously. For example, the stillbirth ratio in Canada was 28 in 1938 and 18 in 1952; in Costa Rica, 35.8 and 21.5 in 1953; in Ceylon, 66 in 1938 and 40 in 1953; in the Netherlands, 25.3 in 1938 and 17.7 in 1953.

In many countries, the tables indicate, stillbirth ratios increase after mothers reach the age of 30. The risk of stillbirths appears to increase the number of previous pregnancies the mother has had. With few exceptions the stillbirth ratio is lower at every age for first and second births than for later births.

The reliability of stillbirth statistics is "highly variable," a note states. "Many countries with relatively adequate statistics of live births and deaths may have quite inadequate stillbirth statistics."

Life Expectancy Rising. A continued decline in infant mortality, in countries for which statistics are available, is shown in tables dating back to 1920. In some countries, the infant mortality rate in 1953 was less than

one-third of the 1920-24 average. In Sweden, for example, 61 infants out of 1,000 died in their first year of life in the period 1920-24; in 1953 the rate had dropped to 18.7. In Mexico the rate dropped from more than 200 to less than 100; in Greece, from more than 80 to 43.

Increasing life expectancy is shown in other tables giving previously unpublished material for a number of countries. In England and Wales, for example, a man at the beginning of the 20th Century could expect to live some 48 years; in 1952 his outlook was for more than 67 years.

The highest life expectancy reported is for Norweigan women who—according to calculations based on data for 1946-50—could hope to survive almost 73 years from the time of birth.

The impact of rapid disease eradication can be seen in the life table for Ceylon. Between 1920 and 1946 (a 26-year period), the life expectancy at birth for males in Ceylon increased 11 years, or from 33 to 44 years. But between 1946 and 1952, after malaria control measures had been initiated, the increase was from 44 to 58, an increase of 14 years of life achieved in only 6 years.

The new (1941-1950) life table for India shows an expectancy of 32 years, an increase of 5 years over the previous calculation which related to 1921-1931.

The world-wide improvement in health conditions, as measured by death rates, is also reflected in cause-of-death statistics shown in the *Yearbook* for a large number of countries. Generally speaking, deaths resulting from tuberculosis continued to decrease in relative importance, whereas deaths from heart disease and cancer increased. There is no indication as to the part played by improved diagnosis, the Statistical Office commented.

All these statistics—the relatively high birth rates, the low infant and general death rates, the decreasing stillbirth ratios—point toward larger populations in the future.

The world as a whole is reported to have had a total of 2,547 million inhabitants at the middle of 1953, an increase of 92 million in the three years since 1950. Part of the apparent increase reflects the influence of more accurate estimates of population, based on the many censuses taken around 1950; nevertheless, the Statistical Office believes, it implies an annual percentage increase of well over 1 percent—a fact which must be taken into consideration when future plans for economic and social development are being made.

By areas, Central Europe continues to have the highest population densities (population per square kilometer) of the world, followed by South Central Asia and Southern Europe.

The *Yearbook* contains a section on migration statistics, including data on permanent migrants and information on international travelers.

Statistical Yearbook 1954. United Nations. New York: Columbia University Press, International Documents Service, pp. 594, (French and English) clothbound $7.50, paperbound $6.00.

This sixth issue of the UN Statistical Yearbook was prepared by the Statistical Office of the United Nations with the cooperation of the national statistical authorities of over 140 countries and with the assistance of the specialized agencies of the United Nations and other inter-governmental bodies. The 179 tables in this volume provide international statistics on demographic, economic, financial, social and cultural subjects. The territorial coverage of the book is reflected in the country index which lists nearly 250 geographical areas.

Housing Conditions. This *Yearbook* furnishes for over 40 countries data relating to the number, size and equipment of existing dwelling units in urban and rural areas separately, and for nearly 30 countries corresponding data on the density of occupation.

According to the postwar census data given in the book, the most common type of dwelling unit in underdeveloped countries is composed of 1-2 rooms (including kitchen). Thus, in Paraguay 86 percent of the dwelling units had 1-2 rooms, in El Salvador (urban areas) 85 percent, in Panama 80 percent, in Jordan 77 percent (including tents and other non-permanent structures comprising 28 percent of total), in Ceylon 75 percent, in Haiti (Port-au-Prince) 74 percent, in Guatemala (urban areas) 68 percent, in Egypt 56 percent and in the Dominican Republic 53 percent. In Europe, the 1-2 room dwelling unit was also the predominant type in Yugoslavia (urban areas, 79 percent) and Finland (60 percent) and also just after the war (1946) in Czechoslovakia (69 percent) and France (51 percent).

Slightly more than half of all the dwelling units in Australia and New Zealand were in the 5-6 room category, and the 5-6 room category also constituted the largest group, although not the absolute majority of the dwelling units in the United Kingdom (45 percent), the Netherlands (44 percent), Canada (39 percent) and the United States (38 percent). Most of the dwelling units in Denmark, Iceland, Western Germany, Ireland and Norway had 3-4 rooms, and so too had the largest percentage group in Sweden (47 percent), Puerto Rico (45 percent), Spain (42 percent) and Costa Rica (40 percent).

It is stated that more than 2 persons per room (1.5 persons in the United States) is considered for policy purposes to constitute overcrowding. In Paraguay no less than 93 percent of the dwelling units had more than two persons per room, in Panama 57 percent in rural and 40 percent in urban areas, and in Ceylon (urban areas) 56 percent; and there were actually more than 4 persons per room in 26 percent of the rural and 15 percent of the urban dwelling units in Panama and more than 4 persons per bedroom in 34 percent of El Salvador's urban dwellings. In Puerto Rico the percentage of dwelling units with more than 2 persons per room declined between 1940 and 1950 from 23 to 16 percent in urban areas and from 45 to 32 percent in rural areas.

Among European countries in 1946 or 1947, more than 2 persons per room is shown for 29 percent of the dwelling units in Czechoslovakia, for 9 percent of the urban and 20 percent of the rural dwelling units in France, for 16 percent of the rural dwelling units in the Netherlands and for over 13 percent of the urban dwelling units in Ireland (Rep.). In 1940, 50 percent of the rural and 29 percent of the urban dwelling units in Greece had more than 2 persons per room.

At the other end of the scale, there were 1.5 or less persons per room in over 95 percent of the dwelling units in New Zealand (excluding Maoris) and in the urban areas of Canada and the United States, and in around 90 percent of the dwelling units in Belgium, the United Kingdom and Australia, in the rural areas of the United States and the urban areas of Switzerland, the Netherlands and Norway.

Cultural Statistics

Newsprint and Daily Newspapers. The Statistical Yearbook contains tables showing the production of newsprint in 22 countries, the consumption of newsprint—total and per capita—in 72 countries and the number and circulation of daily newspapers in 117 countries.

In 1953, the world (excluding USSR and China) produced about 9,560 thousand metric tons of newsprint, 4 percent more than in the preceding year, 29 percent more than in 1948 and 21 percent more than in the peak prewar year 1937. Of this 1953 world production of newsprint, 54 percent came from Canada, about 10 percent from both the United States and the Scandinavian countries (Finland, Norway and Sweden) and over 6 percent from the United Kingdom. Compared with prewar (1937), the 1953 output showed a rise of 42 percent in Canada, of 9 percent in the United States, of 19 percent in Sweden, or 7 percent in Finland, and a drop of 34 percent in the United Kingdom, the second largest prewar producer and the third largest in 1953, of 15 percent in Norway and of 12 percent in France; Japan lifted its newsprint output in 1953 by 48 percent over 1952 and by 45 percent over the Japanese Empire's 1937 production.

The United States is credited with having consumed 5,467 thousand metric tons of newsprint in 1953, equivalent to about 57 percent of the world (excluding USSR and China) production in that year and 69 percent more than the average prewar consumption (1935-39). The second largest consumer was the United Kingdom, with 723 thousand metric tons, substantially more than in the earlier postwar years but 42 percent less than the average prewar figure. The next most important consuming countries in 1953 were Japan (414 thousand metric tons) and France (370 thousand metric tons).

Before the war (1935-39 average), per capita consumption of newsprint was highest in the United Kingdom (26.4 kilos), followed by the United States (25.1 kilos), Australia (24.3 kilos), New Zealand (21.0 kilos), Canada (15.8 kilos), Denmark (13.9 kilos) and Sweden (13.8 kilos). The 1953 data show that the United States was then far ahead with a per capita newsprint consumption of 34.2 kilos, and that per capita newsprint consumption had risen to 21.9 kilos in Canada and to 18.3 kilos in Sweden while it was down in the United Kingdom to only 14.2 kilos, little more than half the prewar average but nevertheless 45 percent greater

than it had averaged during the period 1946-50.

Book Production. In 1953 most works on *applied sciences* were published in the United Kingdom (2,985), France (1,953), the United States (1,601), Italy (1,151) and Bulgaria (965).

The category grouping the largest number of titles is "literature," and in this field the United Kingdom was well ahead in 1953 with 6,760 titles issued, followed by the United States with 4,641 titles, France with 3,206 titles (including works on philology), the Netherlands with 3,068 titles (including works on philology), Spain with 2,779 titles and Italy with 2,475 titles. In the preceding year (1952), Western Germany produced 3,535 and Japan 2,888 works classified under literature.

Radio and Television. The *Statistical Yearbook* contains data on the number of radios (wireless receivers) and television sets licensed or in use.

According to estimates given in the *Yearbook* there were about 230 million radios in use in the world in 1953. Of these, more than half—120.5 million—were located in the United States and about one-third—70 million—in Europe; Asia had some 16 million, South America 5 million, Oceania 3 million and Africa 2 million. It is estimated that there were 520 radios for every 1,000 inhabitants in North America, 220 in Oceania, 175 in Europe, 40 in South America, 12 in Asia and 10 in Africa.

Figures for television sets in use or licensed at various dates in the first half of 1954 are given for 22 countries, and it is noted that regular television broadcasts are made in another 9 countries for which data on the number of receiving sets are not available. Two countries appear to have outdistanced all others in the number of television sets, the United States with 31.5 millions and the United Kingdom with 3.4 millions. Canada is credited with 665 thousand television sets, and elsewhere in the Americas, Cuba is estimated to have 150 thousand, Mexico 90 thousand, Brazil 70 thousand, Venezuela 20 thousand and the Dominican Republic 1.2 thousand sets. In Europe, France had, after the United Kingdom, the largest number licensed, 72.2 thousand sets, followed by Italy with 35 thousand sets, Western Germany with 27.6 thousand sets and Belgium with 15 thousand sets. There were only some 400 sets licensed in both Spain and Sweden, 1,300 in Denmark and 2,800 in Switzerland.

In January 1954 there were some 5,000 television sets licensed in Japan and in the same month the USSR claimed to have 700,000 television sets.

Ten Years of United Nations Publications, 1945 to 1955. United Nations. Obtainable from all UN sales agents at fifty cents per copy or equivalent in other currencies. In the United States; international Documents Service, Columbia University Press, New York 27, New York; in Canada, the Ryerson Press, Toronto; in United Kingdom, H.M. Stationery Office, London.

This is a special reference volume describing all United Nations publications which have appeared since 1945 to help mark the tenth anniversary of the opening of the San Francisco Conference which drafted the UN Charter.

The 271-page volume, issued by the UN Department of Public Information catalogues and briefly describes all UN publications and official records made available to the public over the last ten years. Its 2,252 publications range in price from the 10-cent pocket edition of the United Nations Charter to the *Yearbook of the United Nations* at $12.50. These are among the 108 general publications issued by the Department of Public Information to report the work of the United Nations.

Sixteen other categories of specialized studies and reports describe 232 titles in the field of economics, trade, finance and statistics (including economy of Europe, Latin America, Asia and the Far East, and technical assistance); 97 titles dealing with social questions; 136 in the international law and treaty series; 33 demographic studies; and 27 studies on trusteeship and non-self-governing territories. Other categories are transport and communications, human rights, atomic energy and armaments control, and narcotic drugs.

Also included are all official records of the United Nations which can be purchased in final printed form by the public; information concerning League of Nations publications; documents of the San Francisco Conference and the London meetings of the UN Preparatory Commission; mimeographed documents; visual material; and special information services relating to films, radio and television. The publications of the specialized agencies are *not* included.

The publications program of the United Nations involves the reproduction and dissemination of a vast body of international data obtained from official sources available to the UN or submitted as specialized studies or reports by the Secretariat at the request of the General Assembly, the Economic and Social Council or other UN organs. This material is primarily for use by the United Nations bodies as well as by member governments as information necessary for appraising the world situation in various fields and for making international recommendations.

As much of this material is also of permanent value to scholars, editors, teachers, industry and business, extra copies are printed and made available to the public at nominal cost throughout the world. Some of the data is of a continuing nature and is issued as yearbooks or periodical publications covering a wide range of international statistics in economics, finance, trade and general social matters, or dealing with such matters as international law, human rights, and the control of narcotic drugs.

Other material is issued in the form of normal reports and surveys of economic or social conditions in different regions of the world—Europe, Latin America, Asia and the Far East, the Middle East and Africa. Special reports are also prepared from time to time on particular subjects under consideration by the United Nations. Much of this material is available in more than one of the five official languages of the United Nations—English, French, Spanish, Russian and Chinese.

The UN publications program also includes the preparation and printing of books and pamphlets in many languages. This work is carried out to provide the general public with information in simplified form on all phases of the work of the United Nations and the specialized agencies.

In order to obtain as wide a distribution of this material as possible to meet public demand on a global scale, national libraries and centers have been designated as official depositories of all United Nations publications so that copies may be available locally for reference purposes. In addition, over 80 national and commercial booksellers in more than 60 countries have been appointed by the United Nations to serve as official agents in the sale of its publications to those interested in them.

Among Articles to appear in August 1955 Issue are:

The Measurement of the Economic Base of the Metropolitan Area.....JOHN M. MATTILA and WILBUR R. THOMPSON

Reliability of the Yearly Deed Sample of Land Prices and Transfers.....ROBERT L. TONTZ, JEPPE KRISTENSEN and C. CURTIS CABLE, JR.

Industrial Deconcentration as a Factor in Rural-Urban Fringe Development.....LEO G. REEDER

A Reconsideration of Cost of Capital and a Reasonable Rate of Return.....FRED P. MORRISSEY

Rural Underemployment and Industrial Development in the Wisconsin Headwaters Country.....JOHN M. KUHLMAN

National Forest Contributions to Local Governments.....ELLIS T. WILLIAMS

Publications Received

Forbidden Neighbors. By Charles Abrams. New York: Harper & Brothers, 1955. pp. 389. $5.00.

Urban Planning Education in the United States. By Frederick J. Adams. Cincinnati, Ohio: The Alfred Bettman Foundation, 1954, pp. 57.

Commuting Patterns of Industrial Workers. By Leonard P. Adams and Thomas W. Mackesey. Ithaca, New York: Cornell University Housing Research Center, 1955, pp. 135, $2.00.

The Union and the Coal Industry. By Morton S. Baratz. New Haven, Connecticut: Yale University Press, 1955, pp. 151, $3.75.

Henry George. By Charles Albro Barker. New York: Oxford University Press, 1955, pp. 682, $9.50.

Marginal-Cost Price-Output Control. A Critical History and Restatement of the Theory. By Burnham Putnam Beckwith. New York: Columbia University Press, 1955, pp. 277, $5.75.

Farm and Other Operating-Unit Land-Use Planning. By John D. Black. Cambridge, Massachusetts: Harvard University Press, 1955, pp. 119. Under a grant from Resources for the Future, Inc.

In the Shadow of a Defense Plant. A Study of Urbanization in Rural South Carolina. By F. Stuart Chapin, Jr., Theodore W. Wirths, Alfred M. Denton, Jr., John C. Gould. Chapel Hill, North Carolina: Institute for Research in Social Science, University of North Carolina, 1954, pp. 260.

The Growth of the Intercity Bus Industry. By Burton B. Crandall. Syracuse, New York: Syracuse University, 1954. pp. 289.

Housing the Aging. Edited by Wilma Donahue. Ann Arbor, Michigan: University of Michigan Press, 1955, pp. 275, $3.75.

Our National Forests. By Bernard Frank. Norman, Oklahoma: The University of Oklahoma Press, 1955, pp. 233, index, $4.00.

Freedom in Agricultural Education. By Charles M. Hardin. Chicago: The University of Chicago Press, 1955, pp. 266, $4.50. (A documented study of the state of educational freedom in tax-supported colleges of agriculture.)

Floods. By William G. Hoyt and Walter B. Langbein. Princeton, N. J.: Princeton University Press, 1955, pp. 431. $7.50. An analysis of how floods start and gather momentum, the damage they inflict, and what can be done about them. Outline of the judicial and legislative framework involved.

How to Get Land from Uncle Sam. By Harry Kursh. New York: W. W. Norton & Company, Inc, 1955, pp. 207, $2.95.

Economics and Action. By Pierre Mendes-France and Gabriel Ardant. New York: Columbia University Press, a UNESCO publication, 1955, pp. 222, $3.50.

Politics, Planning, and the Public Interest. The Case of Public Housing in Chicago. By Martin Meyerson and Edward C. Banfield. Glencoe, Illinois: The Free Press, 1955, pp. 345, $5.00.

American Agriculture: Its Structure and Place in the Economy. By Roland L. Mighell. New York: John Wiley & Sons, Inc., 1955, pp. 182, $5.00. A mid-century appraisal of the current status of farms and farm people.

Housing Taxation. By Walter A. Morton. Madison, Wisconsin: University of Wisconsin Press, 1955, pp. 280, $4.75.

Private Credit and Public Debt. By Anatol Murad. Washington, D. C.: Public Affairs Press, 1954, pp. 190, $3.75.

The Theory of Fiscal Economics. By Earl R. Rolph. Berkeley, California: University of California Press, 1954, pp. 302, $4.50.

Social Area Analysis. By Eshref Shevky and Wendell Bell. Stanford, California: Stanford University Press, 1955, pp. 68, $1.75. (Theory, Illustrative Application and Computational Procedures.)

Ground Water in California. The Experience of Antelope Valley. By J. Herbert Snyder. Berkeley, California: University of California Giannini Foundation Ground Water Studies No. 2, 1955, pp. 171.

The Urban South. Rupert B. Vance and Nicholas J. Demerath, Ed., Chapel Hill, N. C.: The University of North Carolina Press, 1954, pp. 296, $5.00.

Greenbelt, the Cooperative Community. By George A. Warner. New York: Exposition Press, 1954. pp. 222. $3.50. A record of the effects of planned community life upon its beneficiaries.

Shopping Habits and Travel Patterns. Technical Bulletin No. 24. Washington, D. C.: Urban Land Institute, 1955, pp. 24, $3.00.